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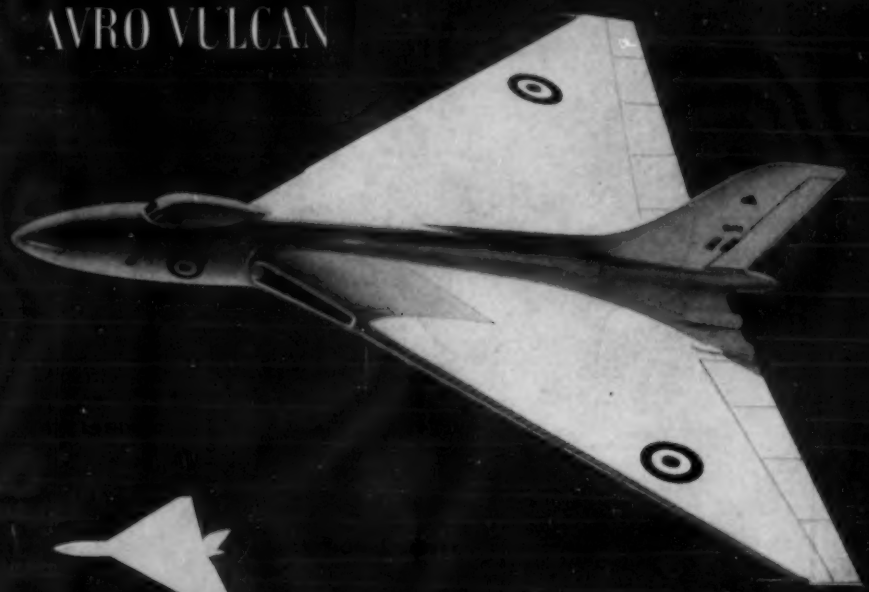

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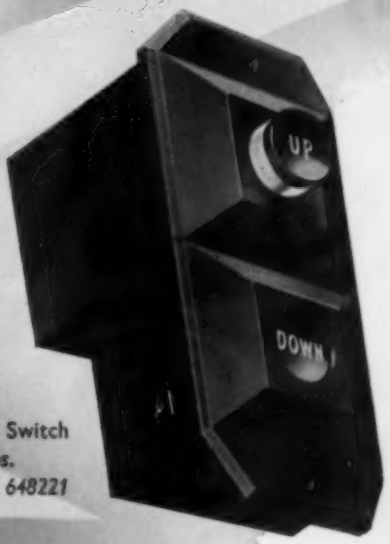

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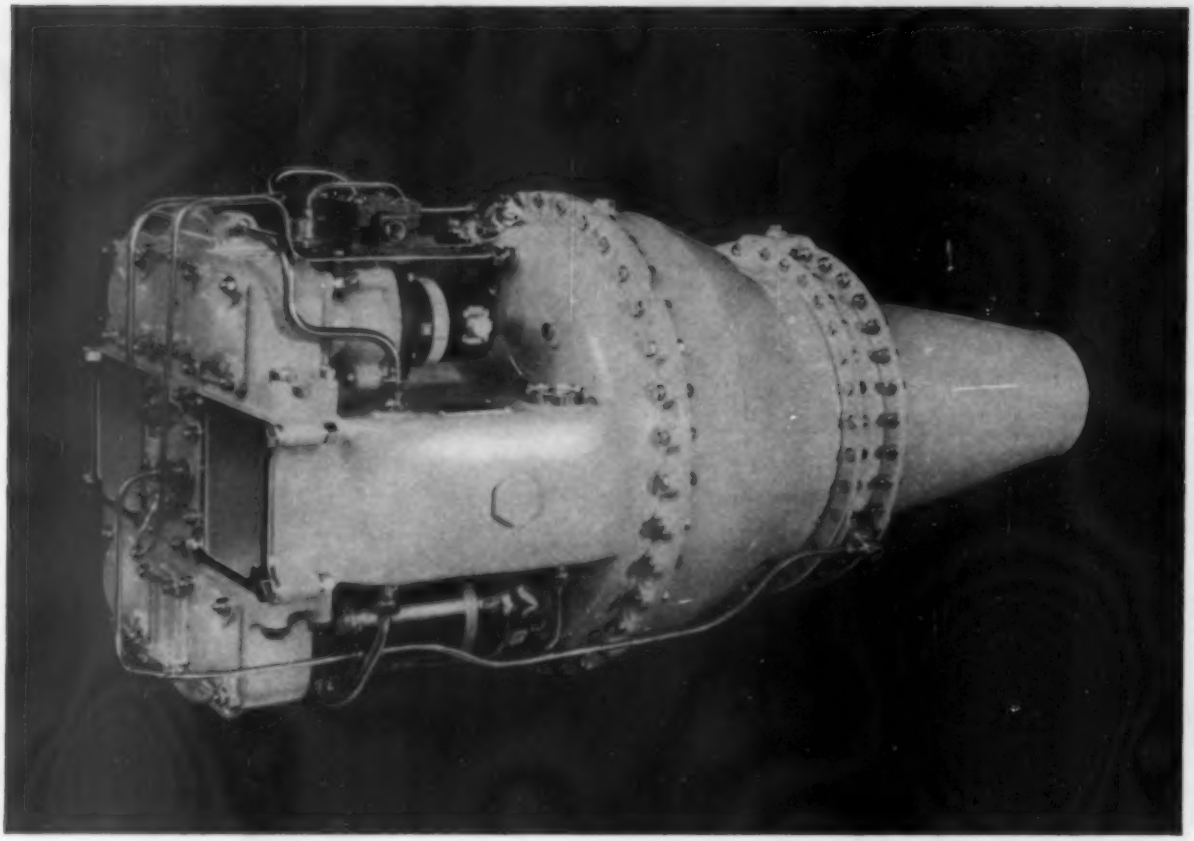

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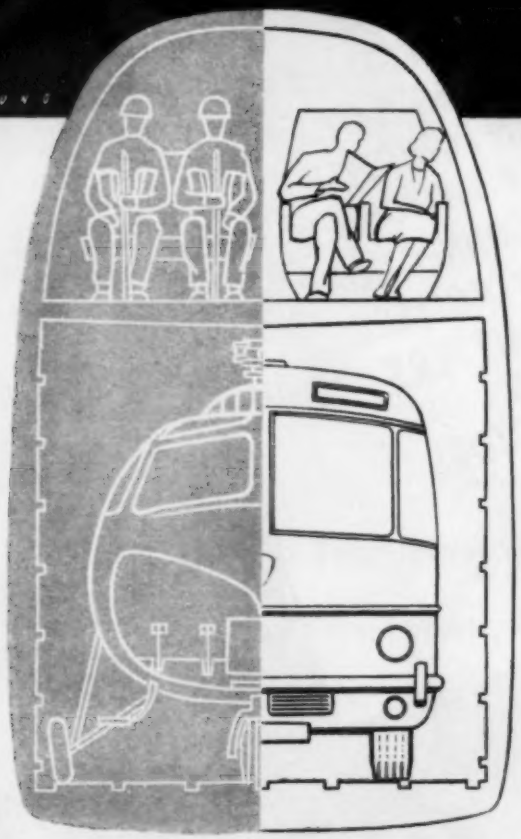

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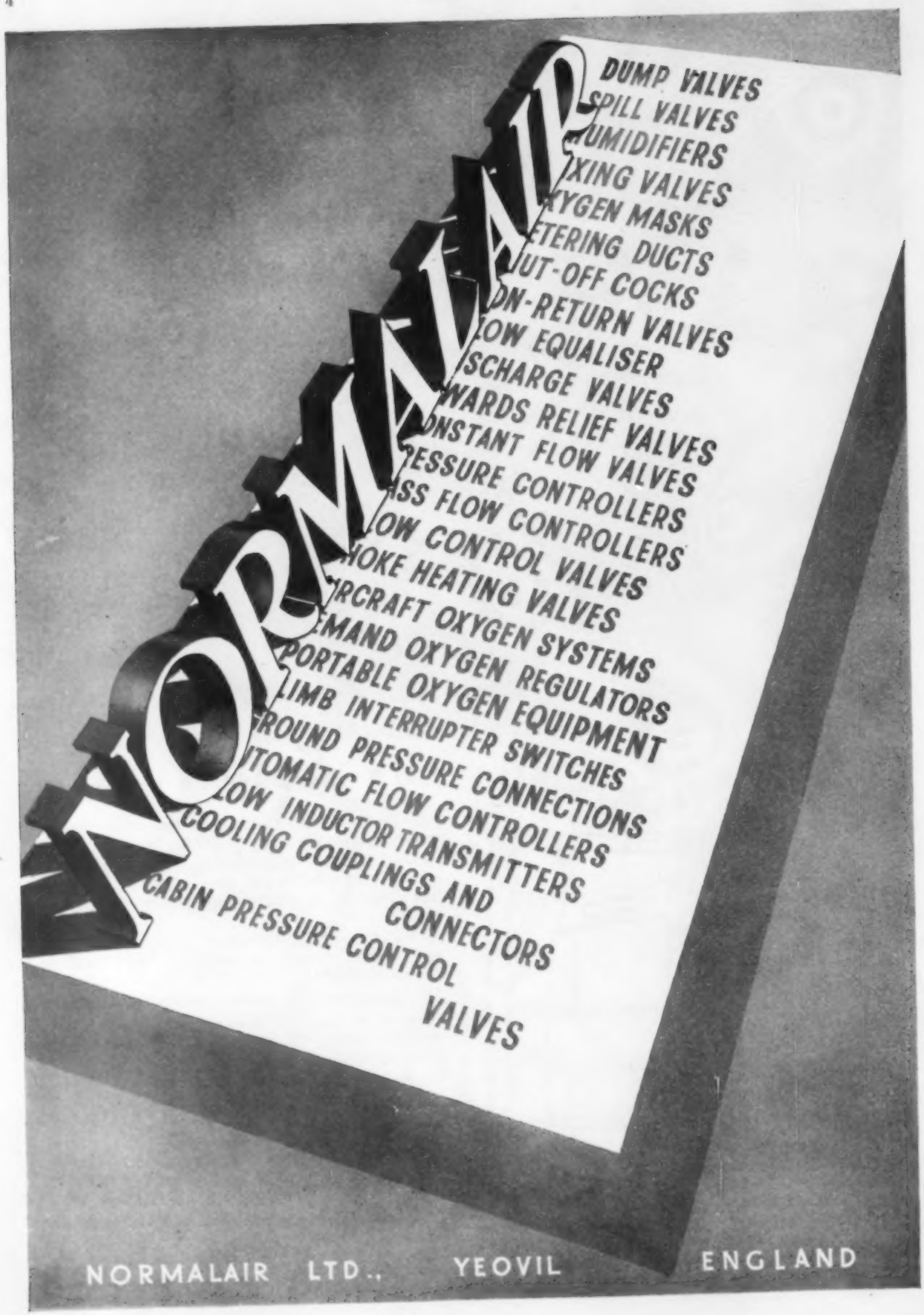
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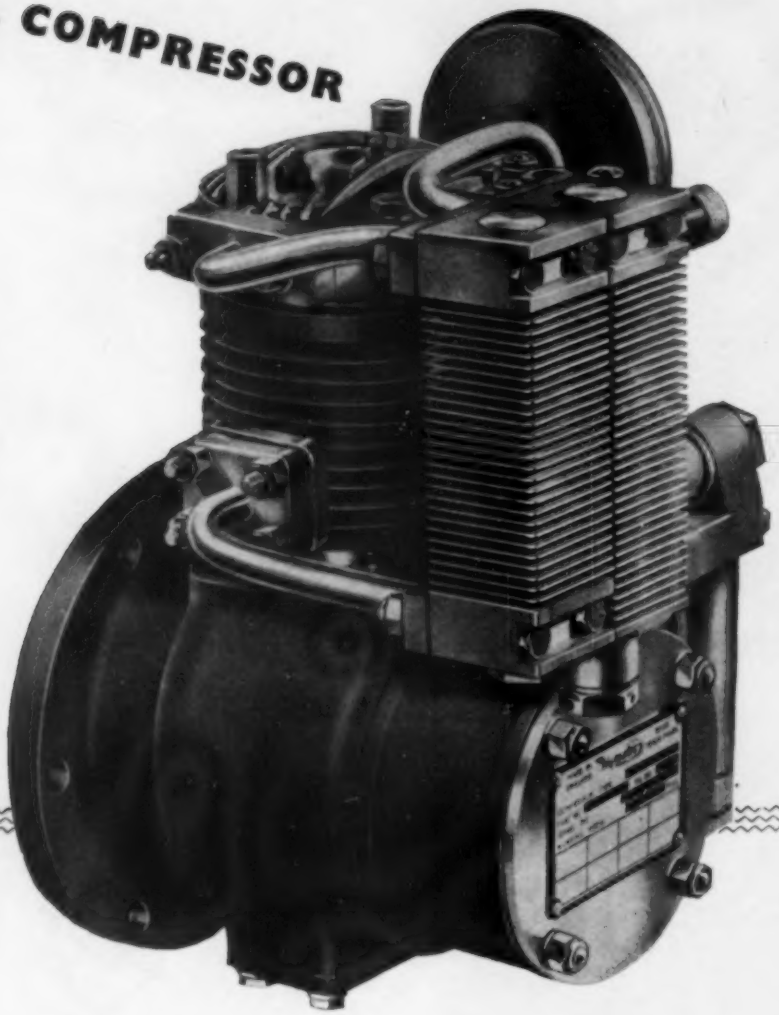

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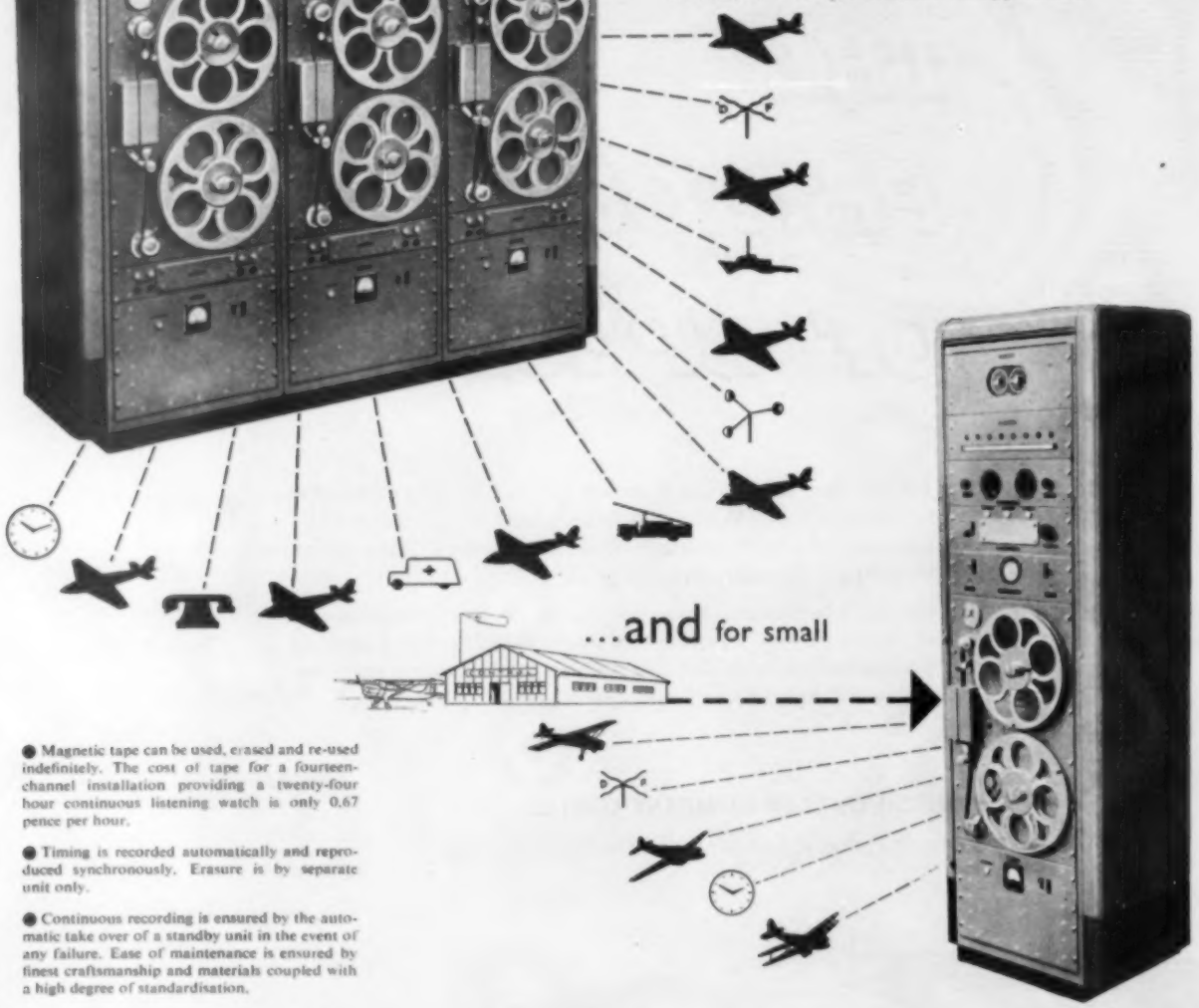

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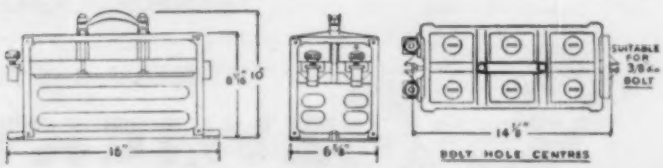

Side and end views of 6-EP19B/2 with battery layout diagram

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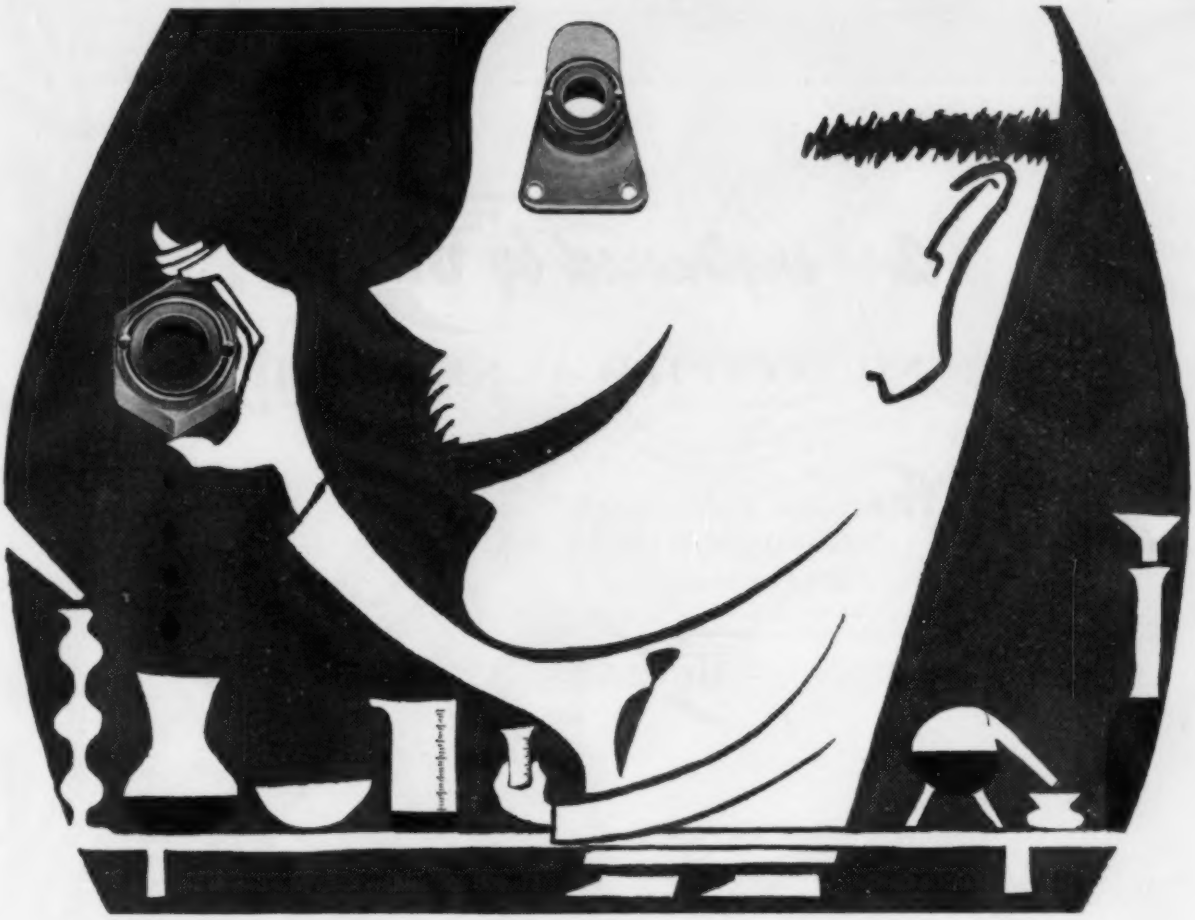

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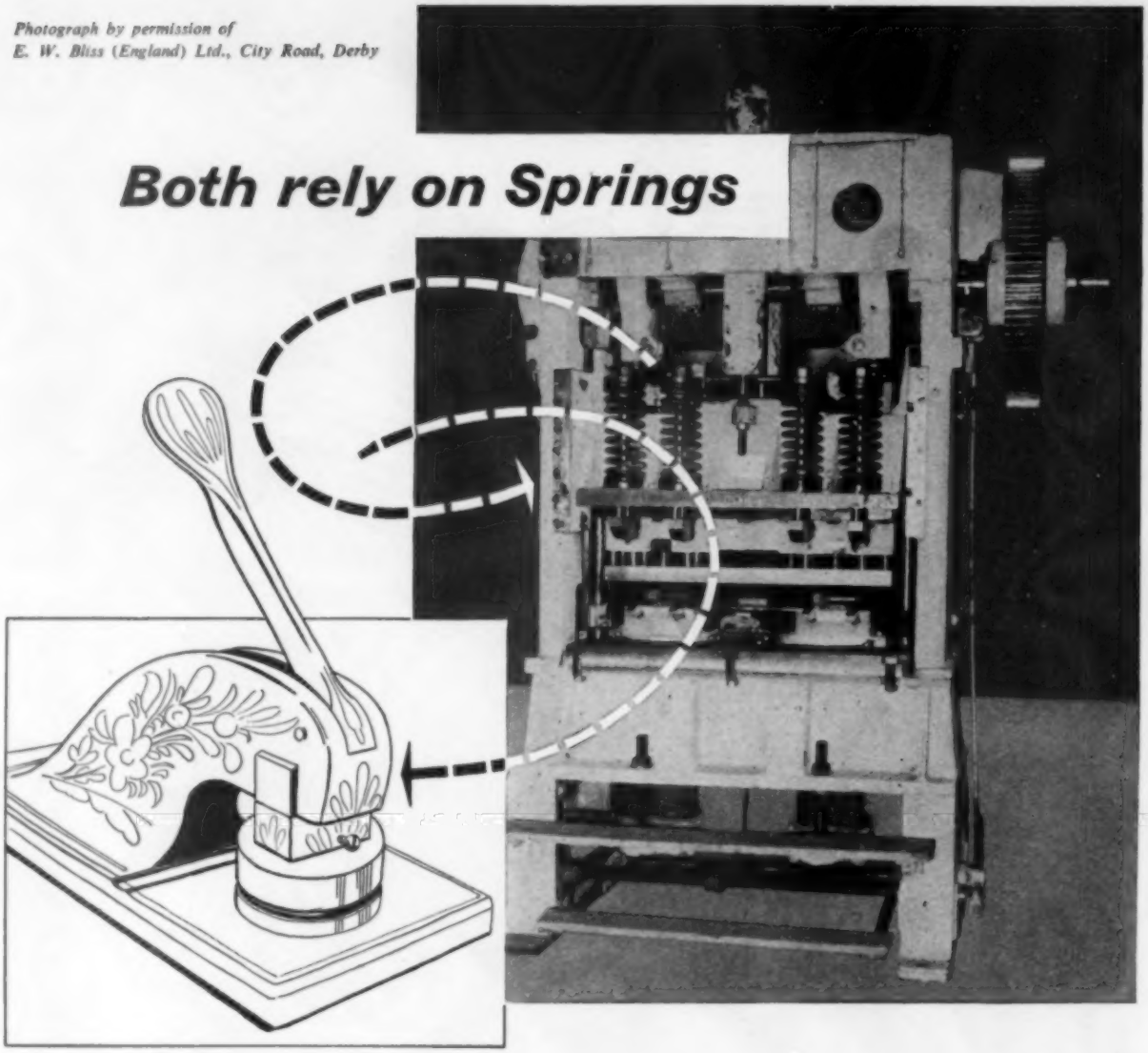

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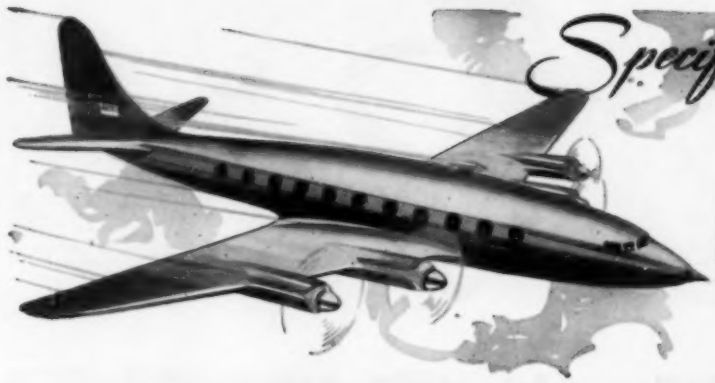

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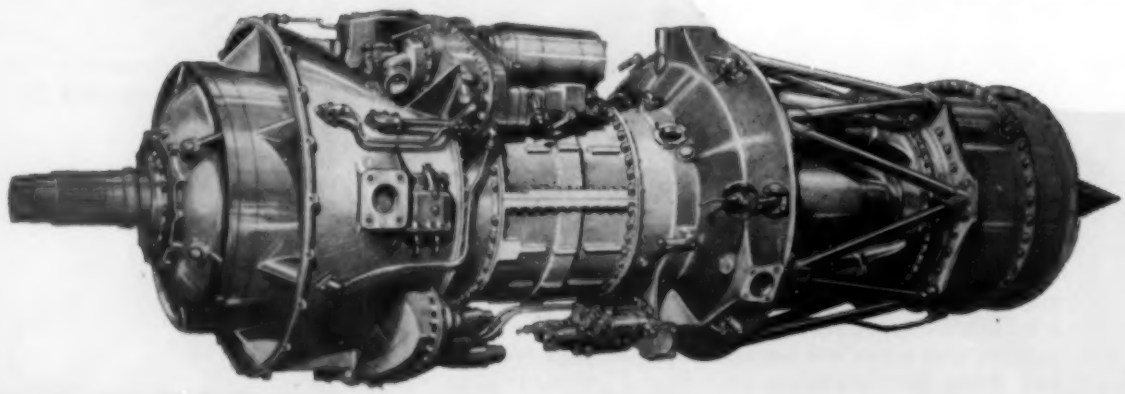

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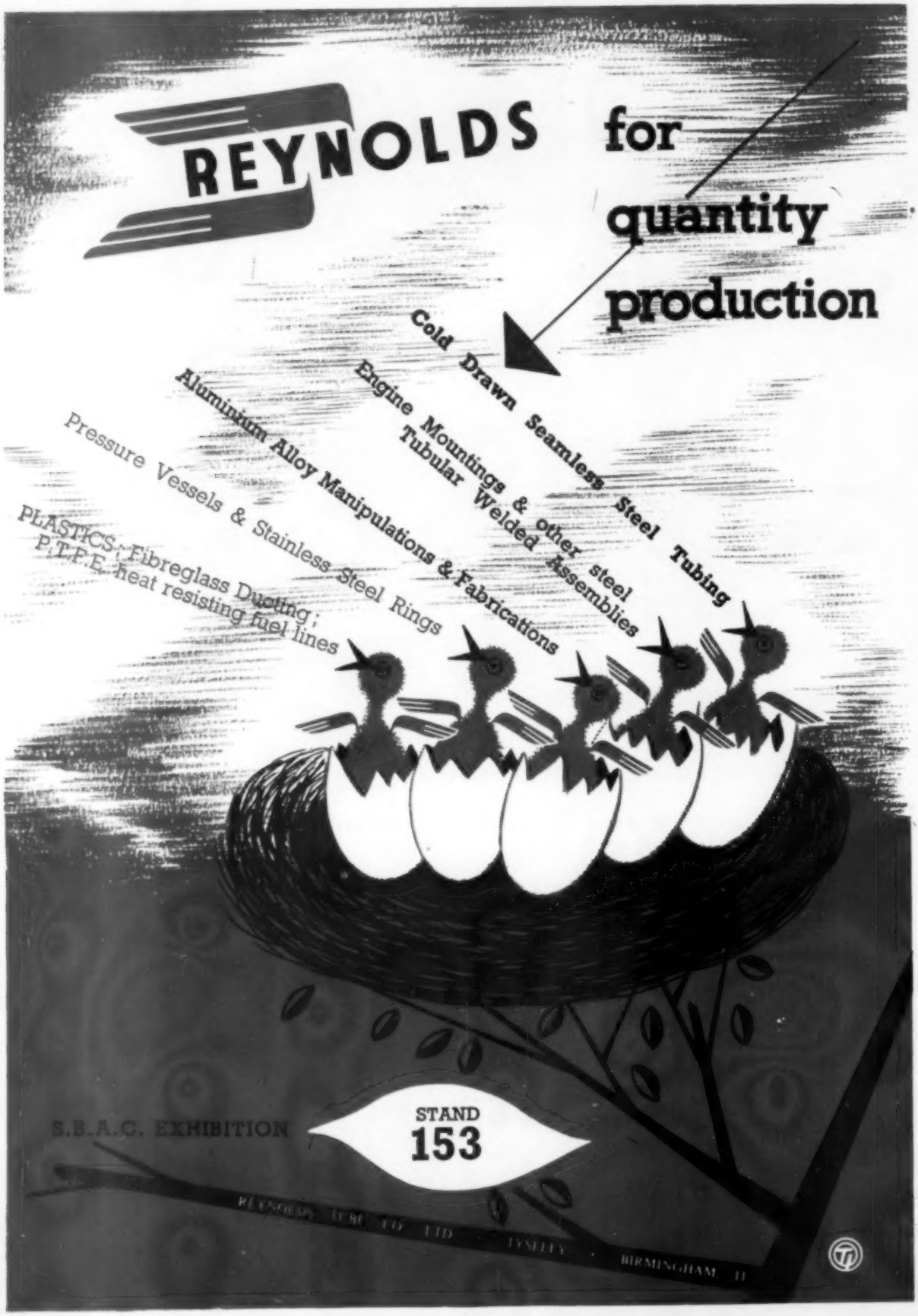
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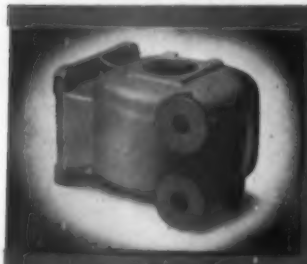

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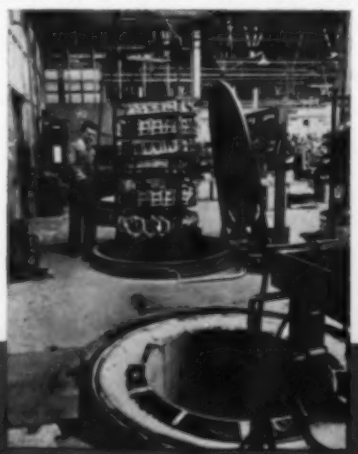

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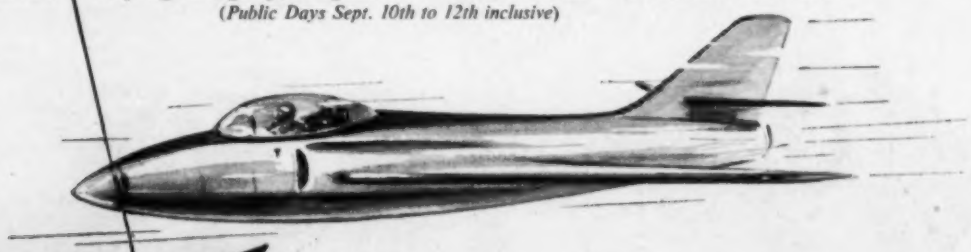

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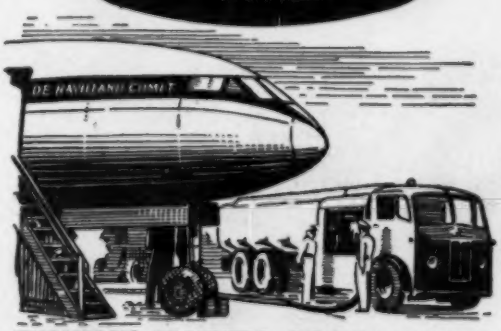

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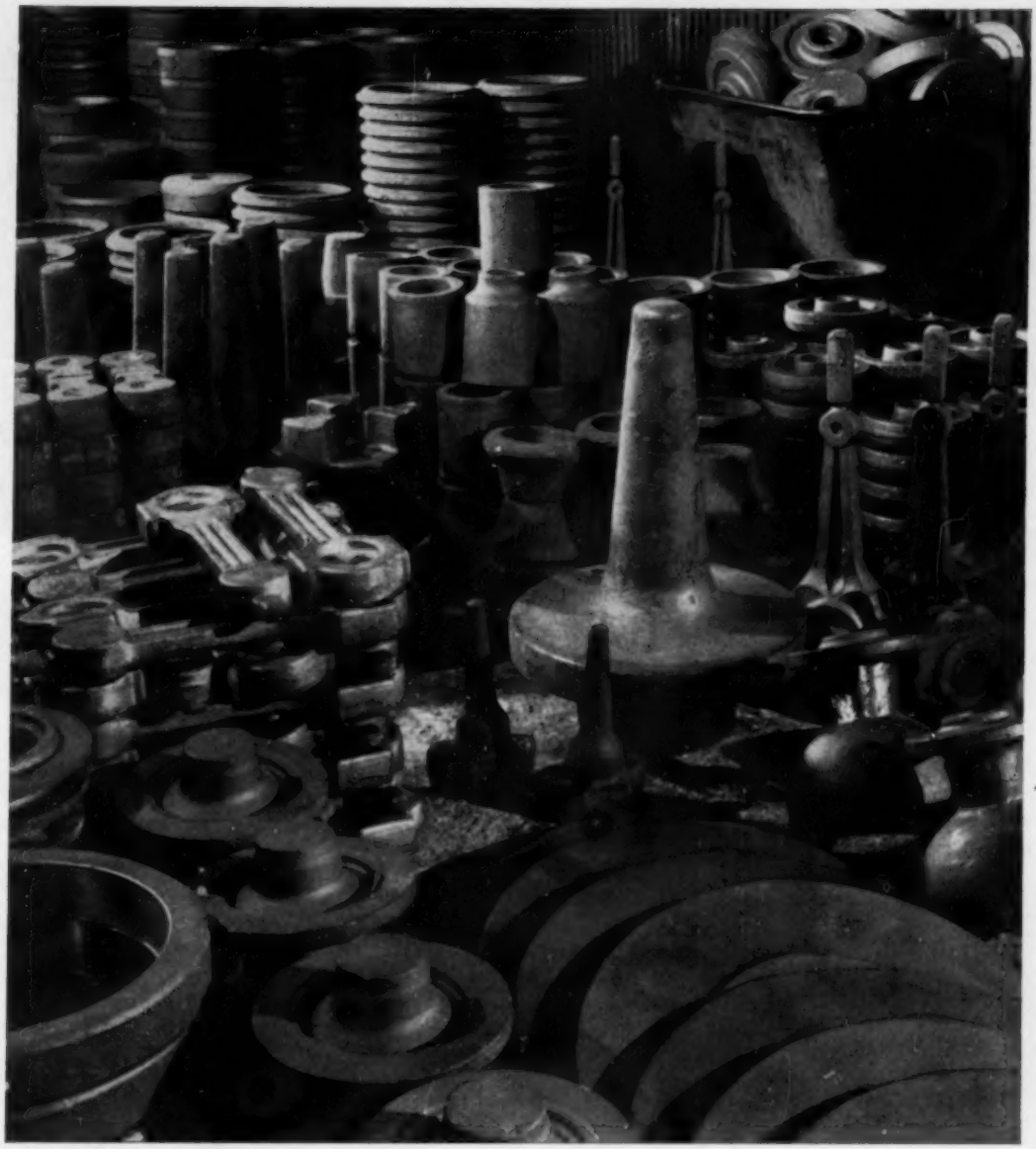

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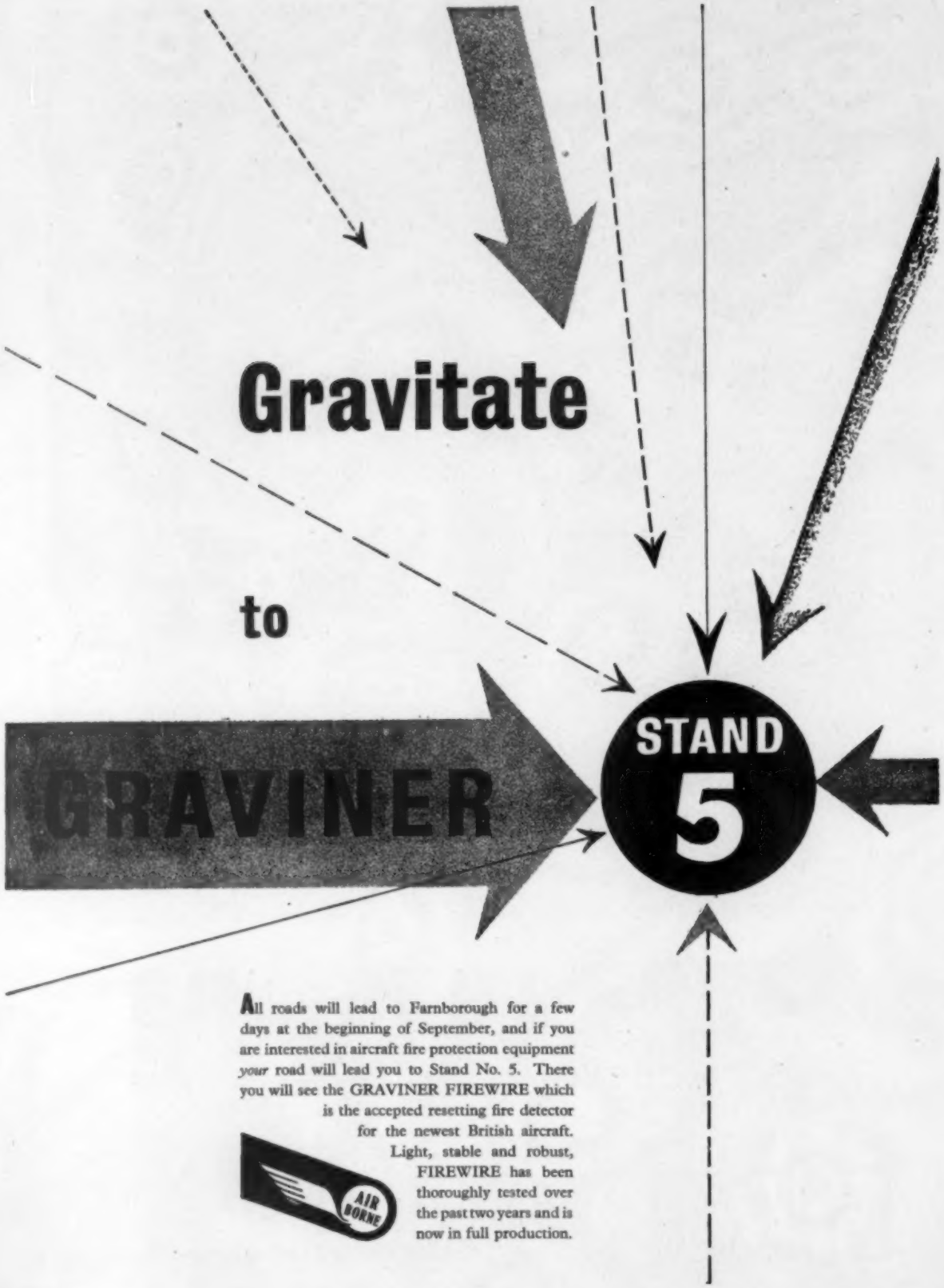

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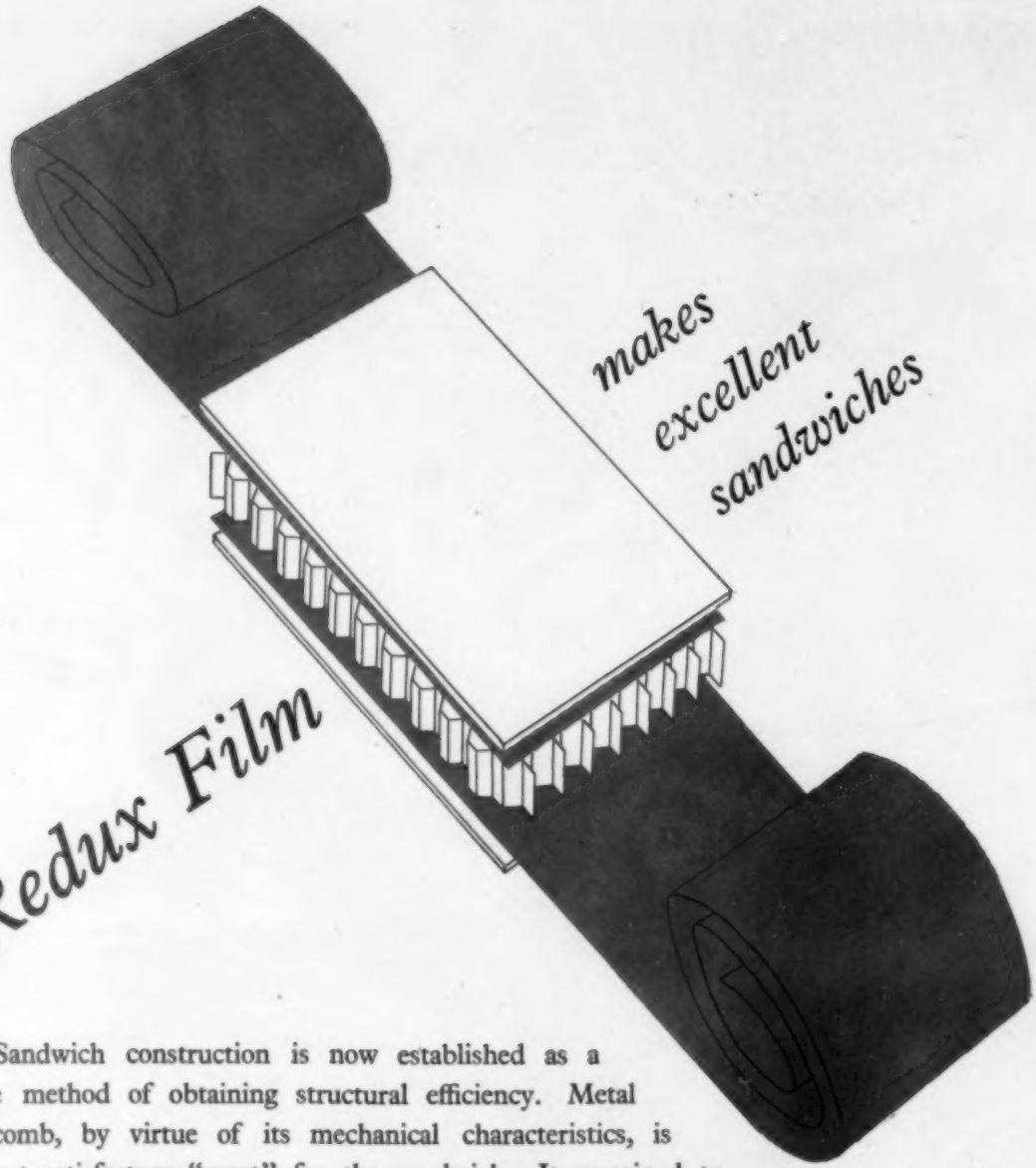

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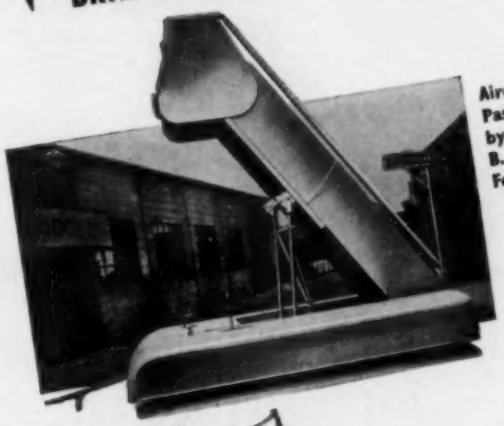
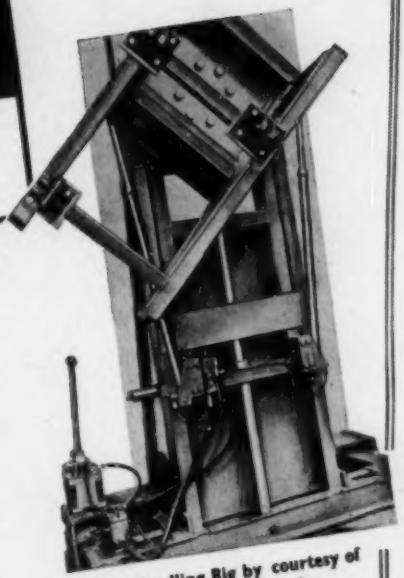


Aircraft Passenger Gangway by courtesy of B. F. Collingridge Ltd. Feltham, Middlesex



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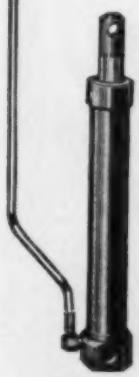

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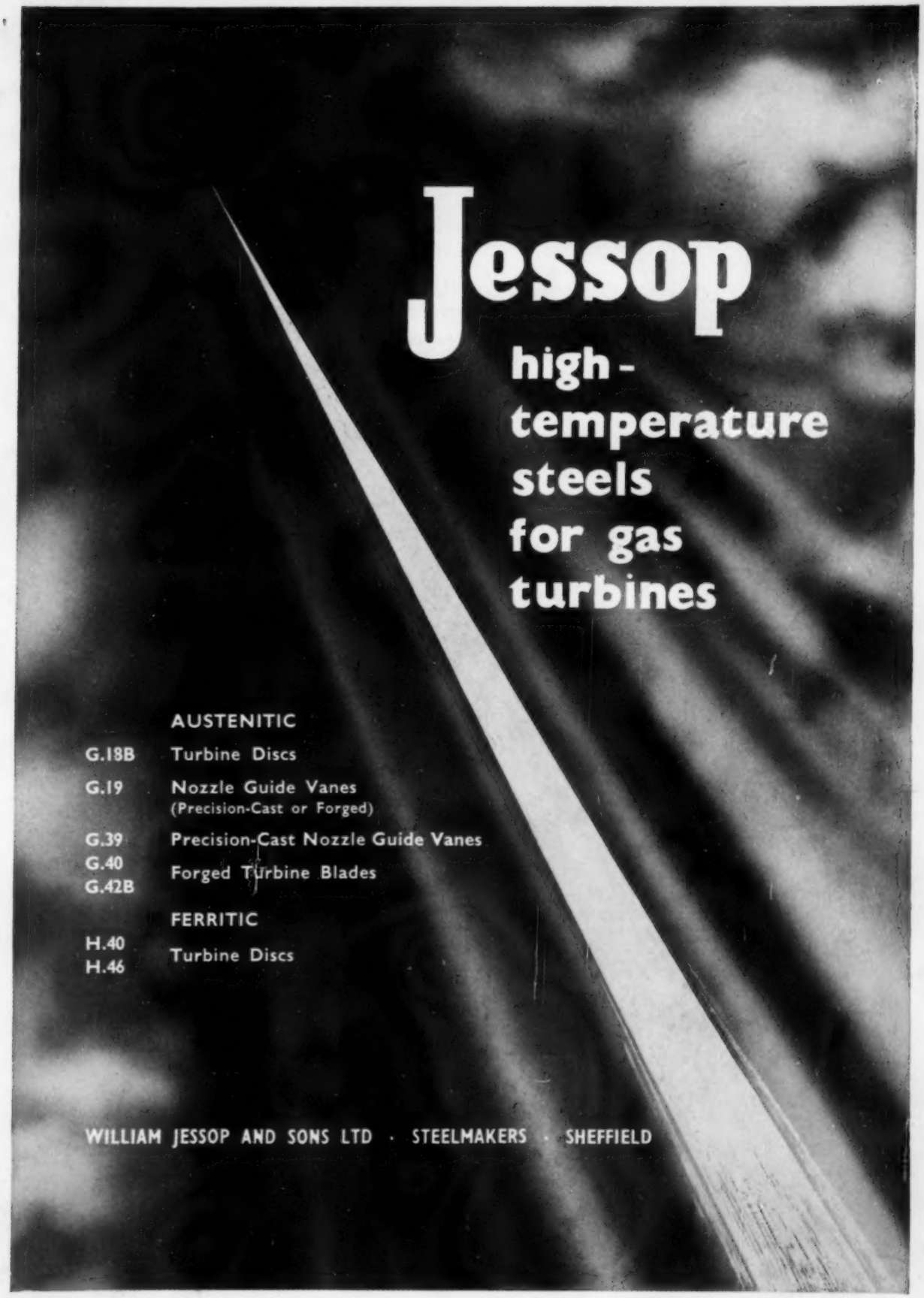
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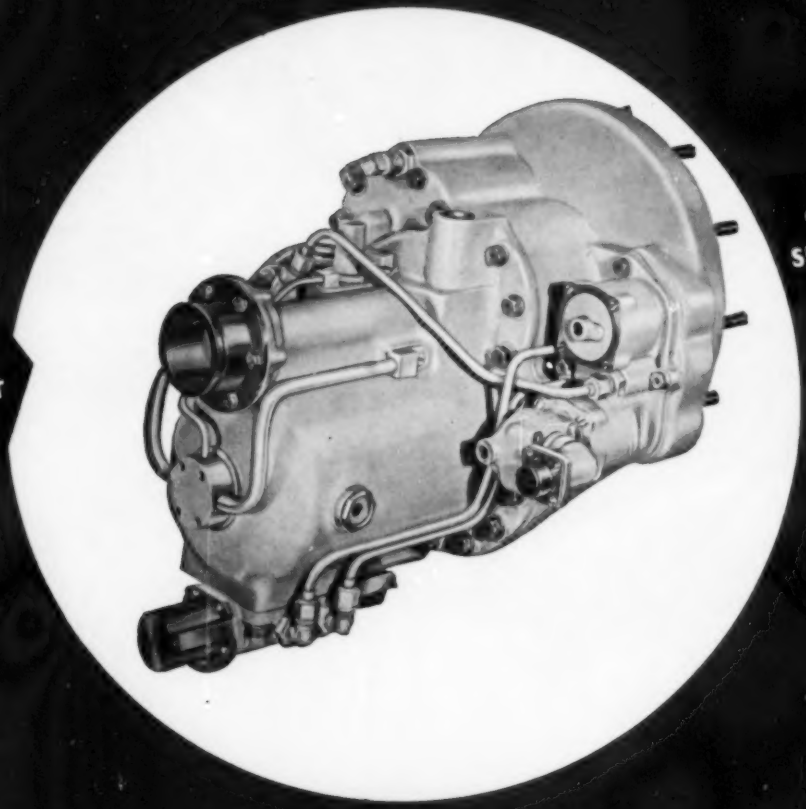

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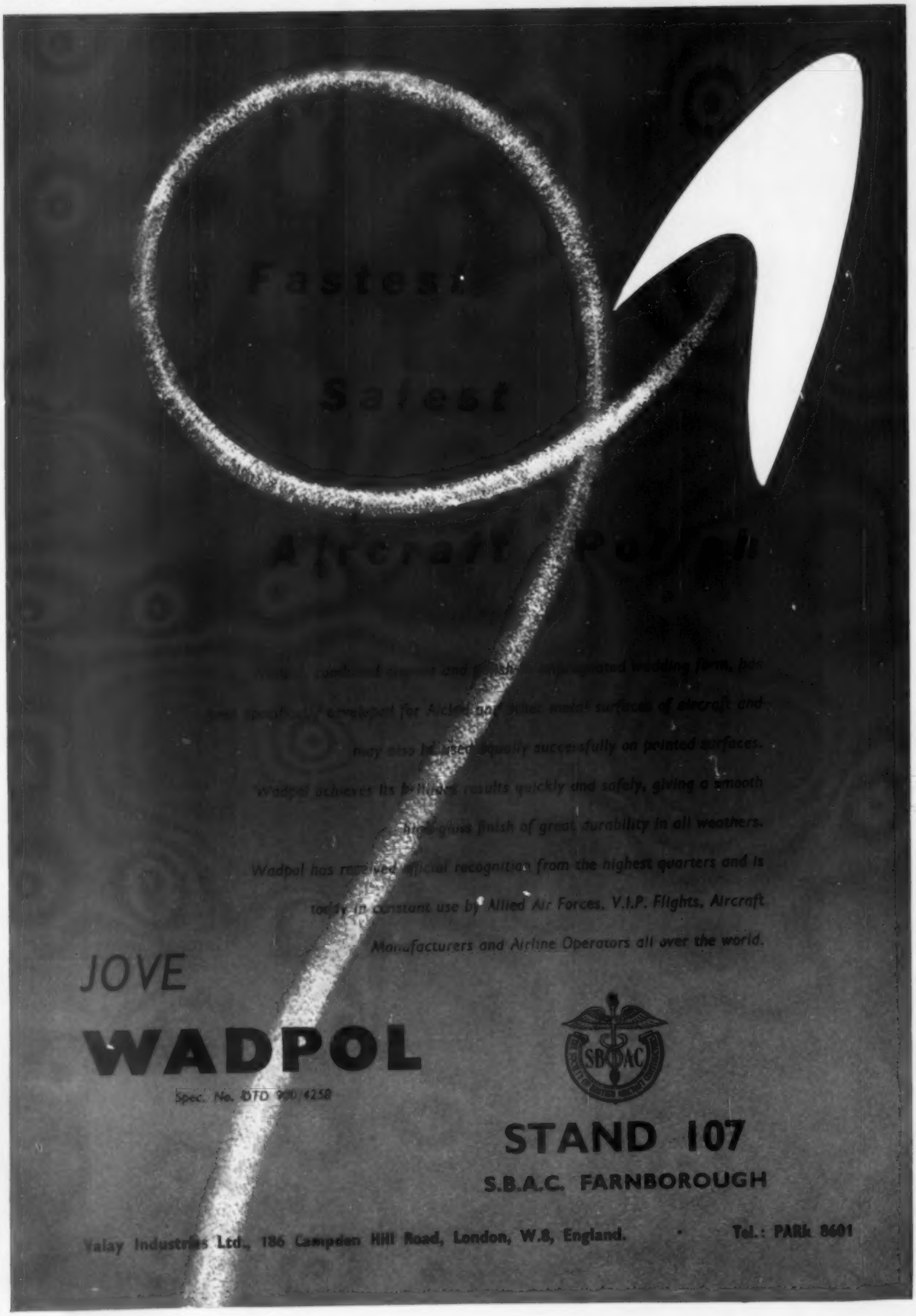
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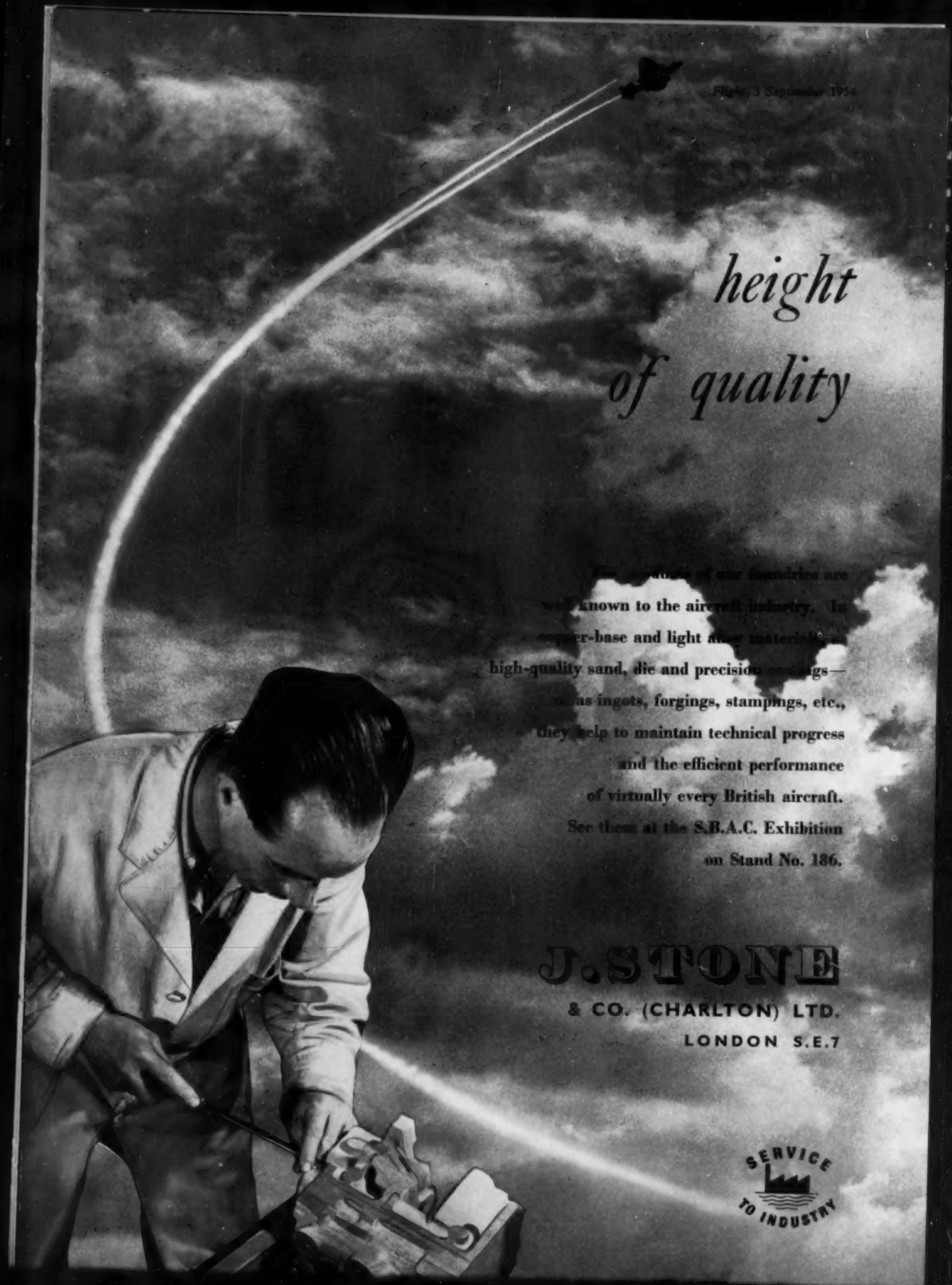

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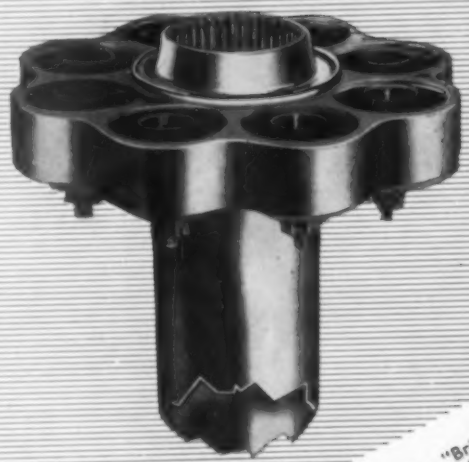

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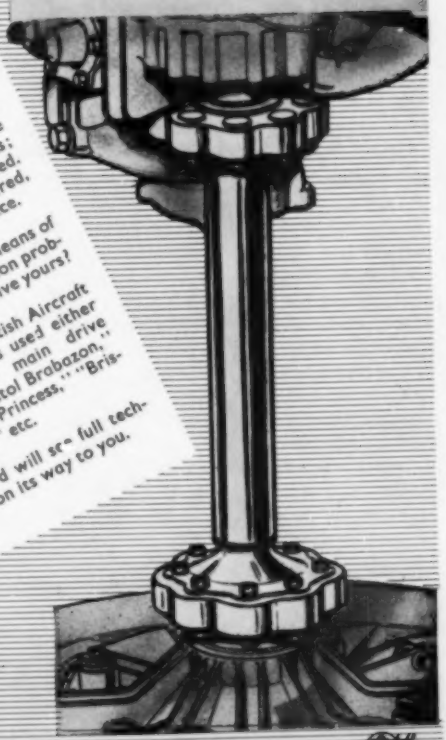

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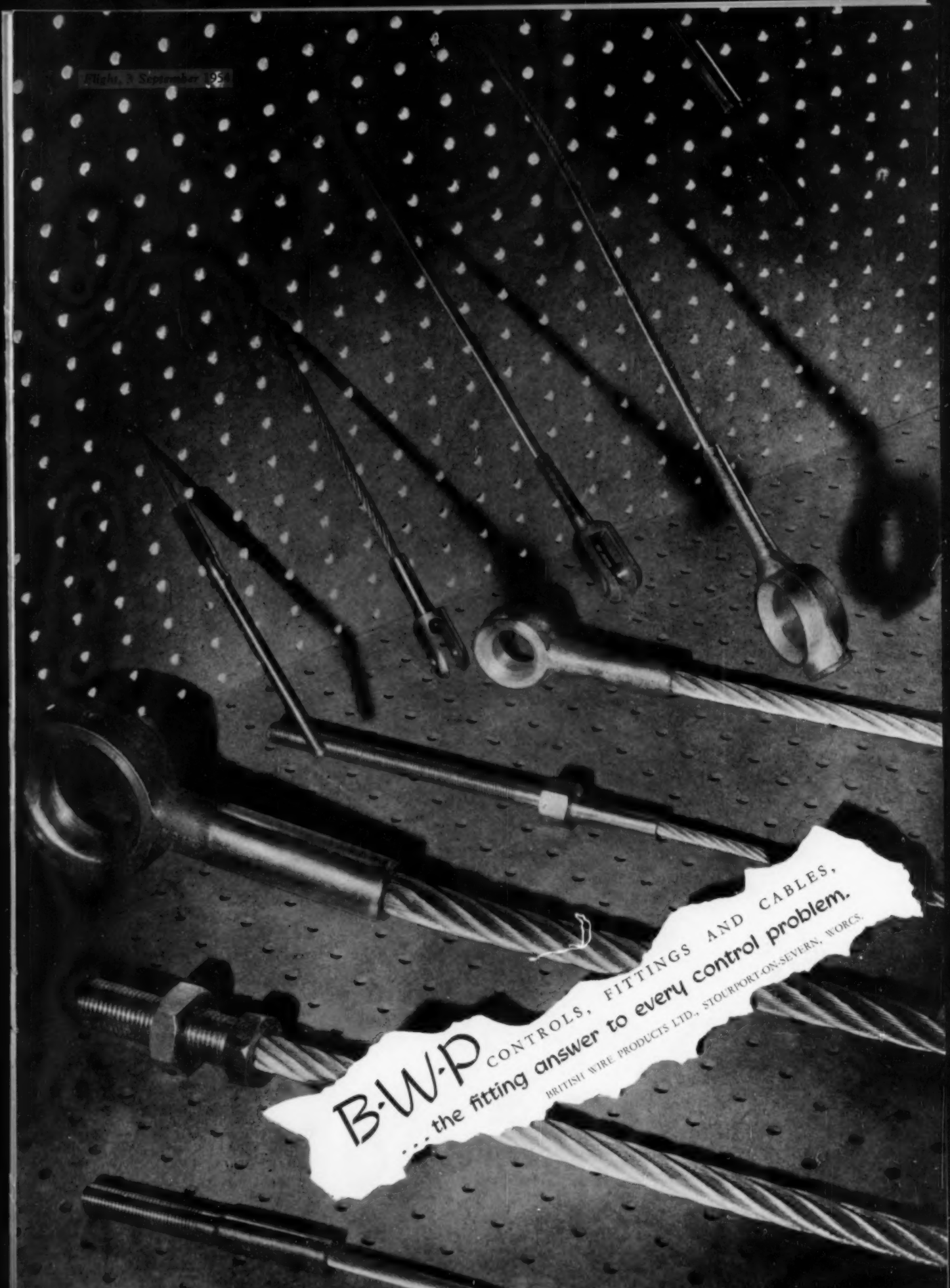
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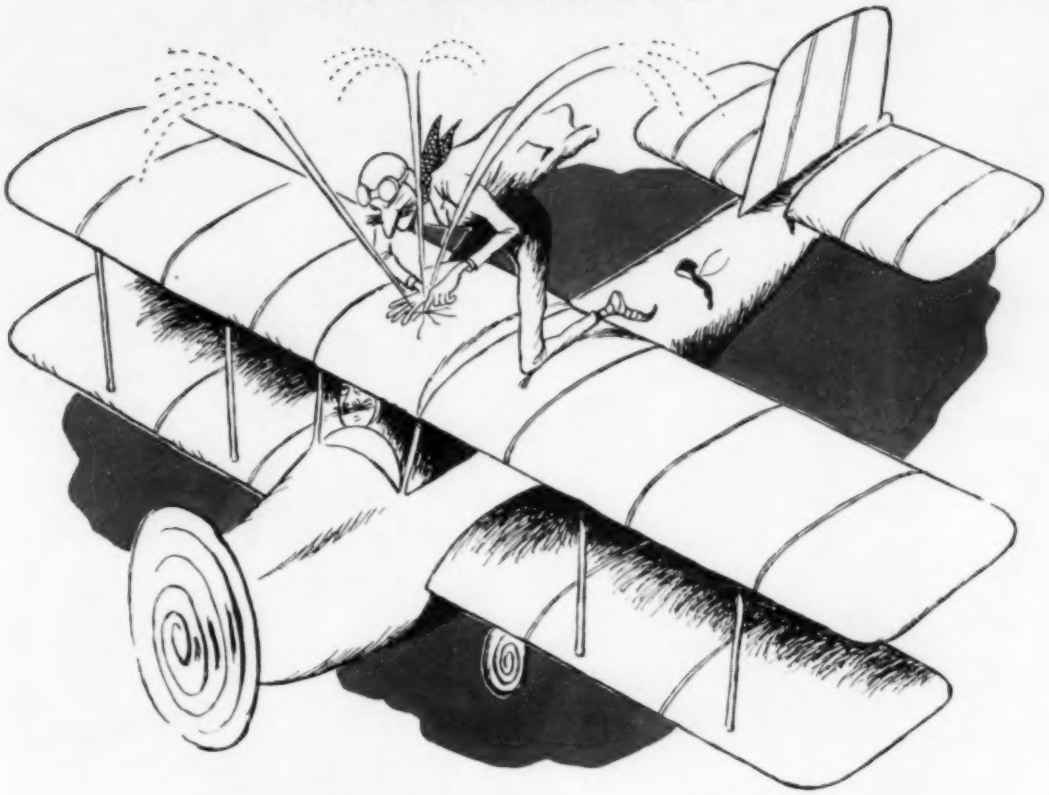

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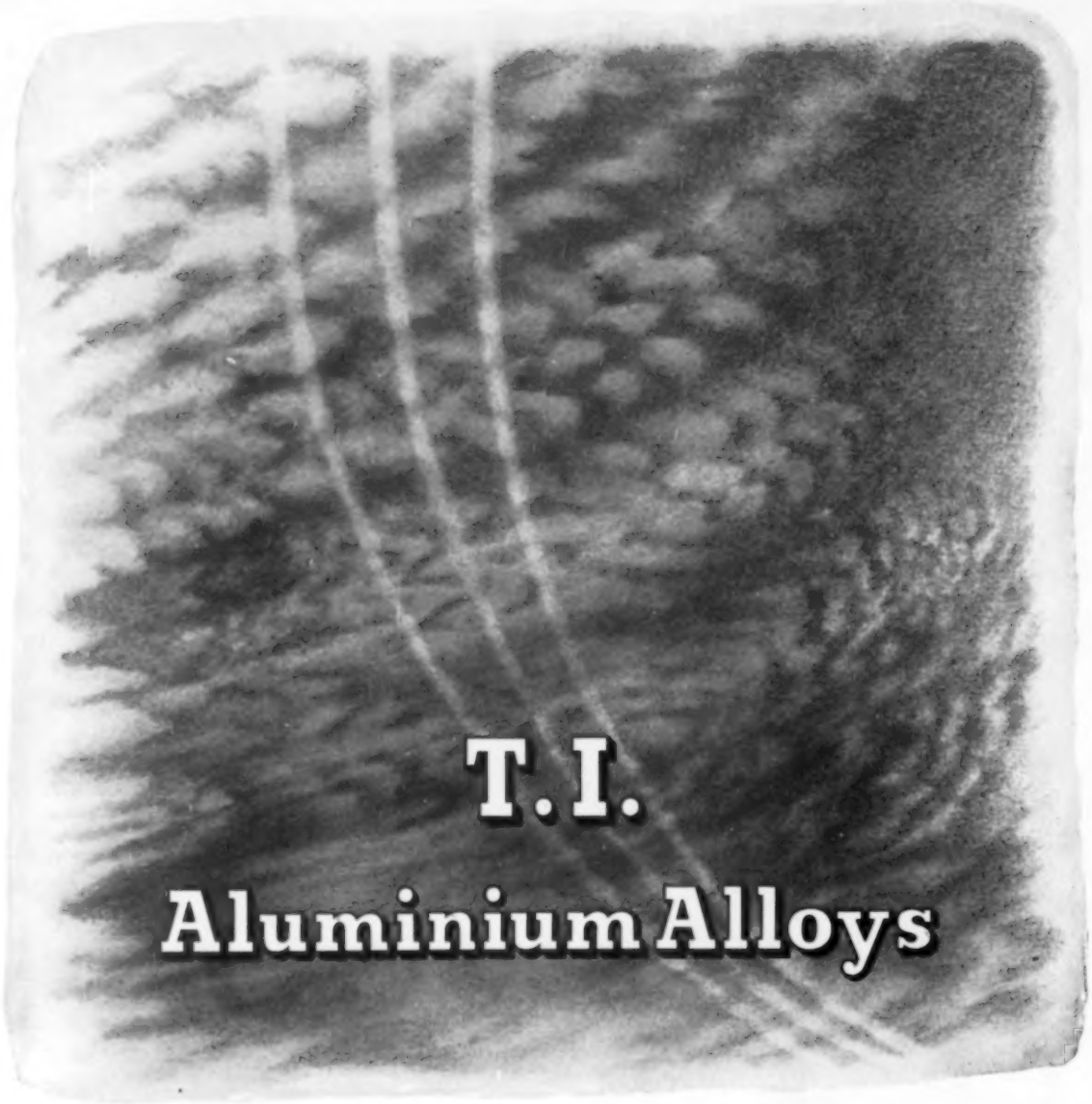

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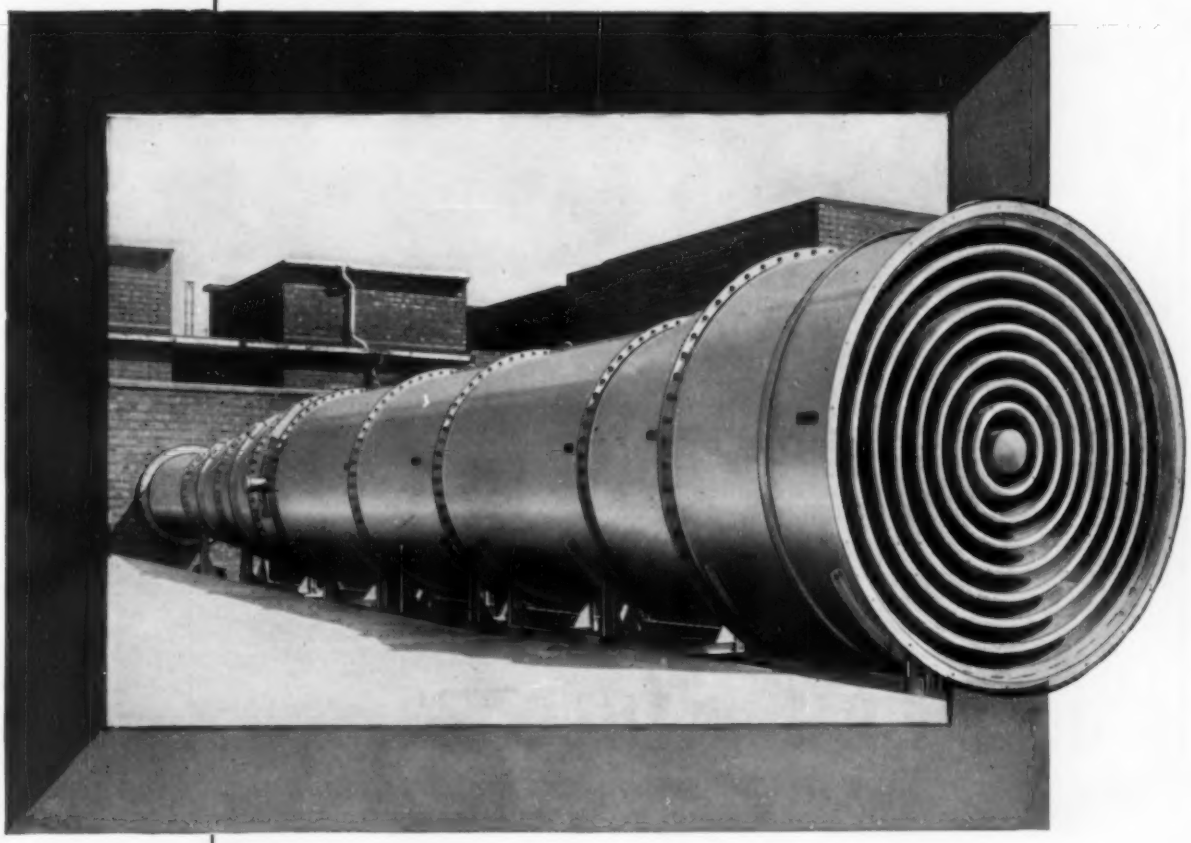

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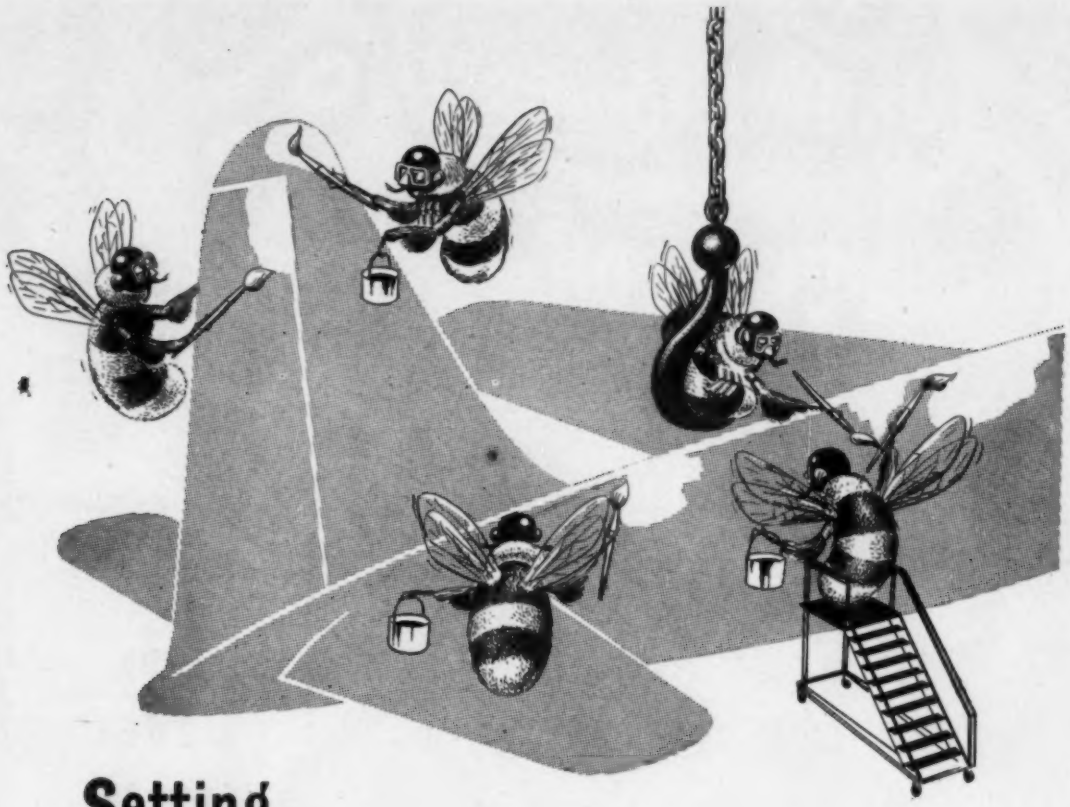

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Dockers' scientists have long realized this need and are constantly developing A.I.D. and A.R.B. approved paints to meet the requirements and combat this damage. Because of these and the many other qualities Dockers are putting into their paints, Dockers' Aircraft Finishes are trusted by the industry. All this adds up to the Docker Service—it's the Docker Service that counts—the service that helps to give aircraft of today their quality and reliability renowned throughout the World.

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TURBINE DISCS and COMPRESSOR WHEELS

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The large Drop Hammers of our Lincoln Forge produce a wide range of TURBINE DISC and COMPRESSOR WHEEL forgings in Heat Resisting Steels for the BRITISH AERO-ENGINE INDUSTRY

SMITH-CLAYTON FORGE LTD · LINCOLN · ENGLAND

Radio Navigation Training with the G·P·R·A...

The General Purpose Radio Aids Unit provides perfect simulation of aircraft. radio navigation and communication facilities and may be used with the simplest form of trainer or the most advanced electronic flight simulator.

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The G·P·R·A will be demonstrated on Stand 235 at the S.B.A.C. Exhibition, Farnborough.

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We invite you to see our exhibit which will feature a representative selection of components, accessories and assemblies produced for the Aircraft Industry on:—

STAND No. 17

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Private Days September 6th-9th
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Whatever the Pressure...

Thermal Control Switches

operate with unfailing accuracy whenever a required pressure is reached

These switches are designed to withstand an overload far in excess of the operating setting. Please write for descriptive literature.

Switches manufactured in ranges from ·4 W.G. to 5,000 P.S.I. and designed to withstand a high overload above their operating setting. Please write for further information.

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SEE OUR RANGE OF PRESSURE-OPERATED SWITCHES AND THE FIRETEC ON STAND 261, S.B.A.C. SHOW

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KEEPS AHEAD OF TIME

SCIAKY SLOUGH ENGLAND

We are exhibiting at the S.B.A.C. Show at Farnborough, Sept. 6th-12th. See our Stand No. 111.

The Gen Book contains all the latest information you want to know about Sciaky Resistance Welding Processes.
Write for your copy today.

Production needs SCIAKY SLOUGH ENGLAND *Welding*

SCIAKY ELECTRIC WELDING MACHINES LIMITED

FARNHAM ROAD, SLOUGH, BUCKS, ENGLAND

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ALSO AT LONDON BIRMINGHAM MANCHESTER PARIS CHICAGO CALCUTTA AND JOHANNESBURG

To meet the needs of modern Civil and Military Aircraft VARLEY have developed a thin plate high efficiency battery, which has the lowest weight/energy ratio ever achieved in Lead-Acid battery construction either in this country or elsewhere. With the co-operation of the aircraft industry, extensive tests have been carried out of performance and life under all conditions, and as a result of these tests a number of aircraft manufacturers have adopted the Varley for production aircraft. Amongst the foremost of these are The Bristol Aeroplane Company for the Britannia, and Vickers-Armstrongs for the Viscount.

TYPE: 24.19/25 c.	
24 volt. 20 a.h.	(2 hour rate)
Base dimensions . . .	9⅛ × 7⅛ inches
Overall height	6¼ inches
Weight fully charged . .	38 lbs.

FULLY AEROBATIC
AT ALL ALTITUDES

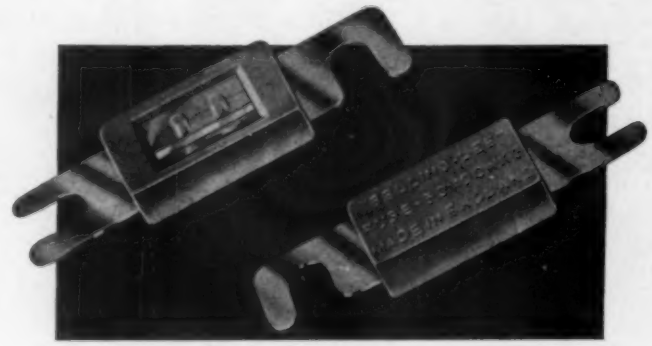
VARLEY DRY ACCUMULATORS LIMITED

BY-PASS ROAD, BARKING, ESSEX

ELECTRONIC COMPONENTS

for the

AIRCRAFT INDUSTRY



IN addition to our wide range of electronic components for communications and navigational aids, radar, etc., are a large number of fuse-links specially designed for aircraft circuits.

Outstanding among these is the L1330 illustrated, which is, so far as we are aware, the only fuse-link of its kind manufactured in this country. Being interchangeable with similar American types, it is a real " dollar-saver " and is available for immediate delivery.

L.1330 has been specially developed for use on 30V. circuits, and is being manufactured in ratings from 35 amp to 75 amp. This fuse-link is very light in weight and is intended for direct bus-bar mounting. It is expected to be explosion proof, and tests in this respect are still being carried out. This type of fuse-link, already in service on considerable numbers of American aircraft, has been chosen for use on the Vickers Viscount and other British aircraft, and A.R.B. and M.O.S. approval is being sought.

Our well-known general purpose instrument fuse-link L.1055 is now manufactured by an entirely new technique which bonds caps, glass and filament into one unit, caps being so securely held that they will not come off unless the glass is broken. The heavier ratings of this range for use on low voltages are now made with strip type elements which will withstand considerable vibration.

A new range of 6 fuseholders for joint service use has been developed and there are also three sizes of heavy duty cartridge fuseholders shortly going into production. Screened plugs and sockets with 3, 4, 6 and 12 way assemblies have been introduced. Assemblies are interchangeable, and in the case of the 3-way, this is intended as a waterproof plug which is eminently suitable for portable lighting equipment.

May we send full explanatory literature, or arrange for a technical representative to call on you?

STAND 8D · S.B.A.C. EXHIBITION
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GREAT CAMBRIDGE RD., ENFIELD, MIDDX., ENGLAND

ACHIEVEMENT IN AIR POWER

"We are part of the community of Europe, and we must do our duty as such."

WILLIAM GLADSTONE 1809-1898

Charlie Smith is a Covent Garden porter. He might not find it easy to put his thoughts into the profound words of this quotation–but it represents his feelings nevertheless. Today the Community of Europe is a matter not of policy, but of life and death. The fate of all free peoples is linked with the fate of Europe, whose freedom depends first and foremost on the superiority of Western air power. Once again, therefore, all eyes are on the display of British air achievements at Farnborough–where the aircraft of the Hawker Siddeley Group of Companies are again taking pride of place. Four major aircraft of the Group are now well into the production stage. The super-priority Hunter and the Sea Hawk are pouring out of the factories for the R.A.F. and NATO, while other super-priority types, the Vulcan and the Javelin follow close behind. Group companies have a long line of thoroughbreds to their credit and it is interesting to renew acquaintance with the most famous and to follow the rapid progression through 45 years of pioneering to the great aircraft which will thrill the world's onlookers during the Display. *The following pages tell a memorable story.*

Hawker Siddeley Group

18 St. James's Square, London, S.W.1

PIONEER . . . AND WORLD LEADER IN AVIATION

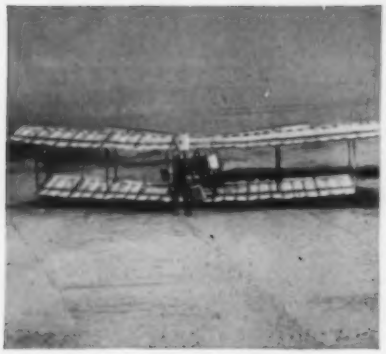
A. V. ROE · GLOSTER · ARMSTRONG WHITWORTH · HAWKER · AVRO CANADA · ARMSTRONG SIDDELEY
HAWKSLEY · BROCKWORTH ENGINEERING · AIR SERVICE TRAINING · HIGH DUTY ALLOYS

E*

Pedigree

Breed

This inset presents a nostalgic record of some of the many, many different aircraft pioneered and built since 1908 by companies of the Hawker Siddeley Group. It is a pictorial pedigree of the great aircraft which these same companies are producing today.



1908. ROE I BIPLANE

1909. ROE I TRIPLANE

1926. ARMSTRONG WHITWORTH ARGOSY

1926. HAWKER HORSLEY

1932. HAWKER AUDAX

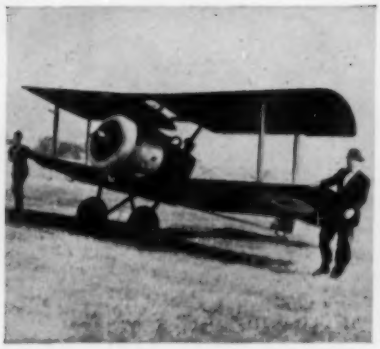
1933. HAWKER DEMON

1941. GLOSTER WHITTLE E28/39

1942. AVRO YORK

1912. AVRO MONOPLANE

1915. AVRO 504 K



1916. SOPWITH PUP

19

1926. GLOSTER GREBE

1927. GLOSTER GAMECOCK

1928. ARMSTRONG WHITWORTH AJAX

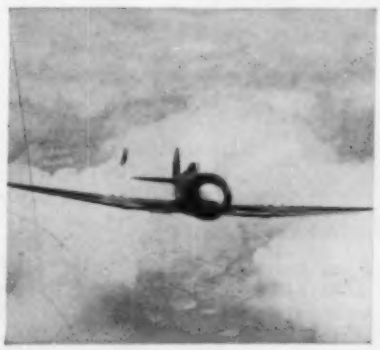
192

1934. GLOSTER GAUNTLET

1934. ARMSTRONG WHITWORTH SCIMITAR

1935. HAWKER HIND

193

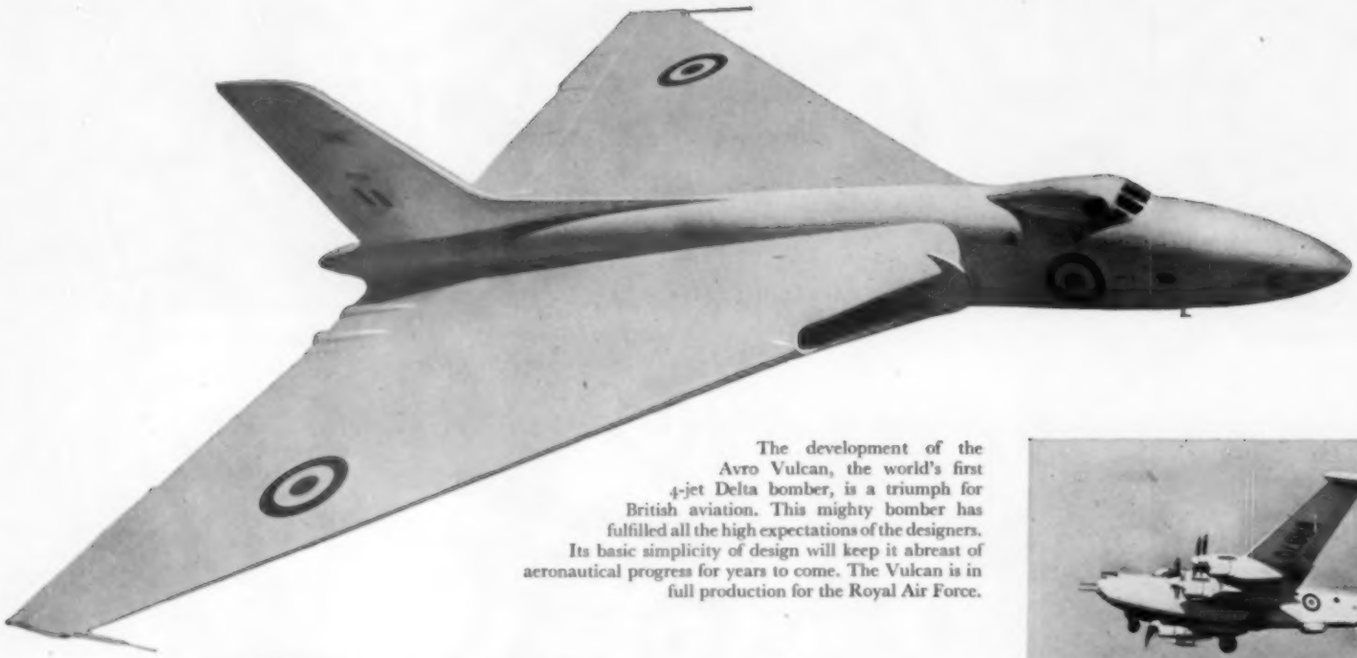


1943. HAWKER TEMPEST 2

1944. HAWKER FURY

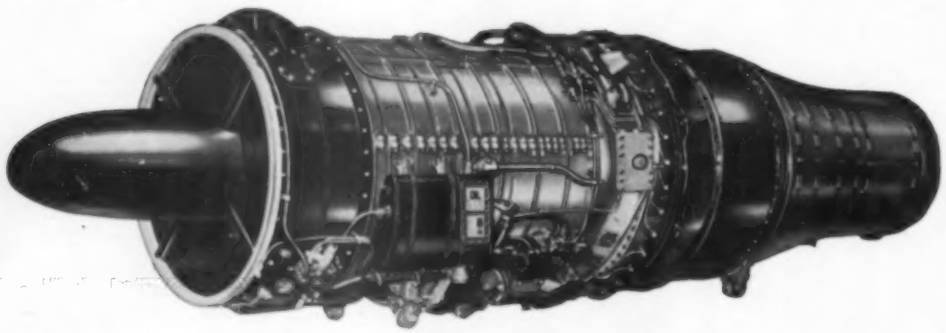
1945. AVRO LINCOLN

194

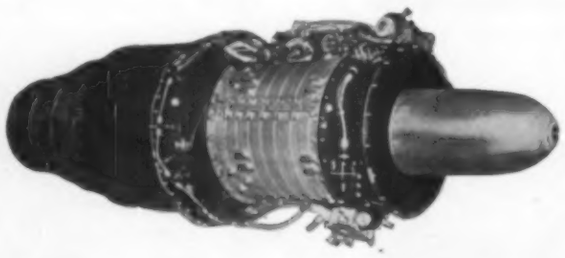


The development of the Avro Vulcan, the world's first 4-jet Delta bomber, is a triumph for British aviation. This mighty bomber has fulfilled all the high expectations of the designers. Its basic simplicity of design will keep it abreast of aeronautical progress for years to come. The Vulcan is in full production for the Royal Air Force.

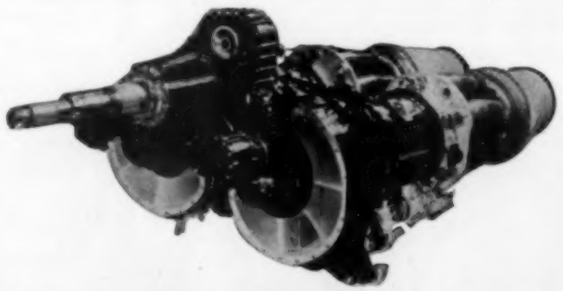
Avro Shackleton Mk. 3 is the most devastating Sub-hunter in the world. Still vaster range, greater search efficiency, finer crew amenities. In the air-sea-rescue role, it also brings a motorised lifeboat to save the lives of ditched survivors. The Mk.3 is in production for the R.A.F. and for the Government of South Africa.



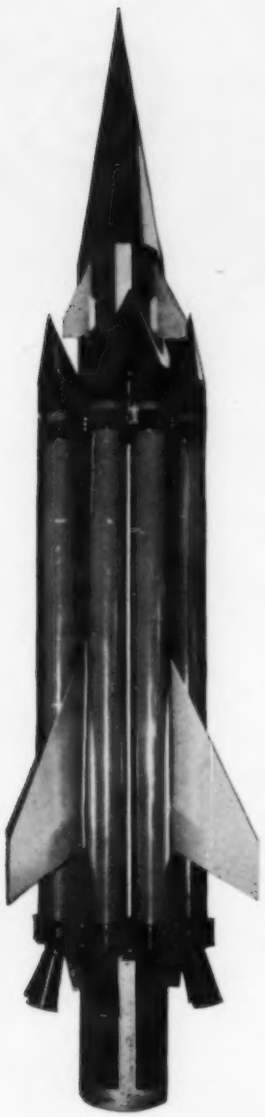
Two modern factories are working full stretch to provide world-famous Armstrong Siddeley Sapphire turbo-jet engines for the latest front-line aircraft. Thousands of flying hours place the Sapphire high among the most dependable and powerful turbo-jets in production. The Sapphire is also being produced, under licence, by Curtiss-Wright in U.S.A.



The Armstrong Siddeley Viper turbo-jet is being developed in two forms–short life for the Australian Jindivik pilotless target aircraft and long life for the Percival Provost jet trainer. The trainer version, the Viper ASV.5, combines simplicity and lightness with very long overhaul life.



The Double Mamba provides twin-engine safety and single-engine economy in one power plant for the Fairey Gannet. With only one half used on normal operation, engine life is greatly prolonged. An interesting development is that the Double Mamba is cleared to fly on Admiralty Diesel Oil and Kerosine. Two new versions, the ASMD 3 and the ASMD 4, can now be mentioned.



The Hawker-designed Sea Hawk jet has lifted Fleet Air Arm strength to a formidable level. Fast, powerful and highly manœuvrable, this is the finest aircraft ever flown from a carrier. In full production by Armstrong Whitworth for the Royal Navy, and an order worth $18,400,000 has been placed under U.S. offshore procurement programme for NATO.

Much successful pioneering of these vital weapons has been carried out by Armstrong Whitworth . . . whose efforts have already ensured for the Group a leading position in guided missile design, development and production.

In the eight bustling years of its existence, Avro Canada The Company designed and produced the CF-100, kin of the North American continent.

Hawker Hunter—the world's finest fighter—is now in service with the Royal Air Force, and more and more Hunters are pouring from the giant Hawker factories to build up British and NATO defensive strength. The recent $182,000,000 order for NATO Hunters is the largest American off-shore order ever placed for aircraft. Hunters have also been ordered by the Governments of Holland, Belgium, Sweden and Denmark.

Avro Canada's
all-weather figh
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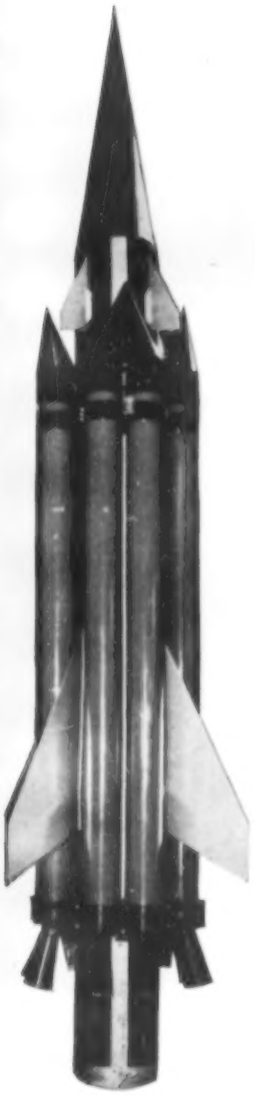
turbine produ
same company,
production for
Canadian Air F



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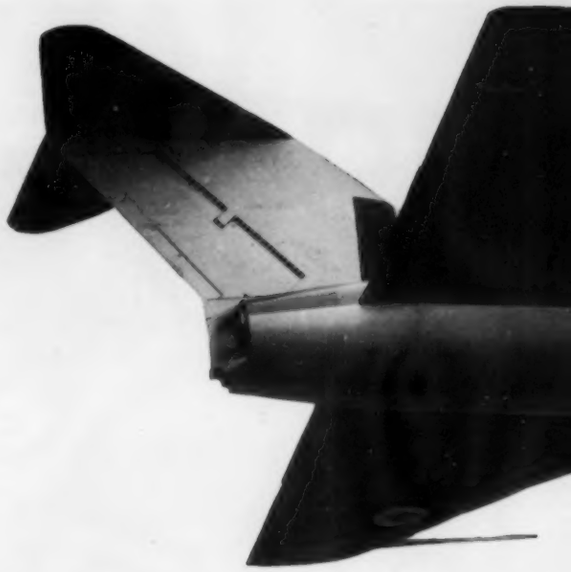

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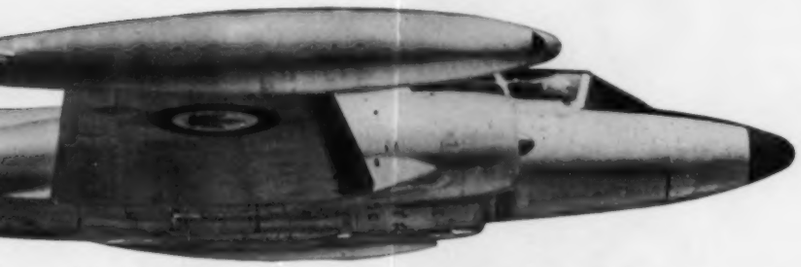
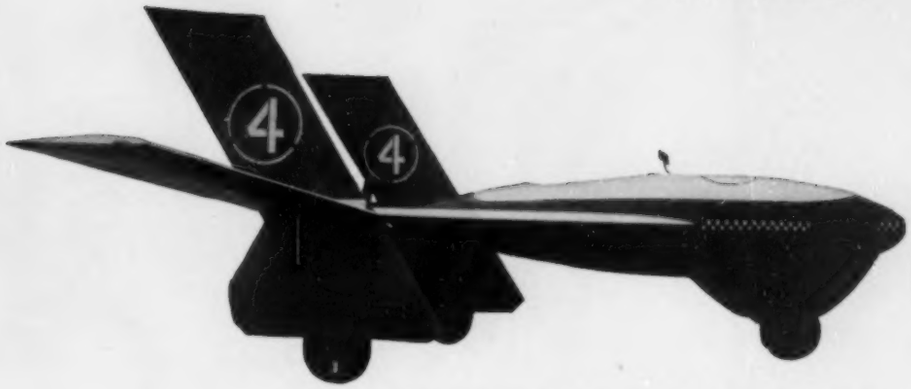
Avro Canada's CF-10
all-weather fighter p
by the Orenda axial-
turbine produced
same company, is in q
production for the
Canadian Air Force.

The Gloster Javelin, world's first twin-jet delta fighter, has a key place in Britain's new defence system. It can operate at over 50,000 ft. in all weather conditions, day or night. Exceptional speed, powerful radar, heavy armament and long endurance make it the most formidable all-weather fighter in the world. Now in full super-priority production for the R.A.F.



has established itself as one of the foremost producers of modern jet aircraft and engines in the world. gpin of Canada's fighter force, to meet the gruelling conditions of Arctic cold and the vast distances



The latest version of the Air Service Training C.4 towed target is a metal-covered target designed for operation at high speeds. Basically all wing, a body is included for sighting at high altitude. The body houses equipment and mechanism. Still in the development stage, great interest is evident in this project designed and built by Air Services Training's Aircraft Division. Here also, repair and maintenance of all types of aircraft is carried out together with conversion and modification and the supply of aircraft equipment.

At Air Service Training's famous flying school at Hamble, pupils from 71 countries have been trained for aircrew and maintenance duties since the school began in 1931. Hundreds of today's airline Captains and key maintenance personnel are graduates of this world-famous establishment. Its Schools of Flying, Navigation, Engineering and Radio-Radar form the stepping-stones to success for the airmen of tomorrow.

F-100 Mk.4
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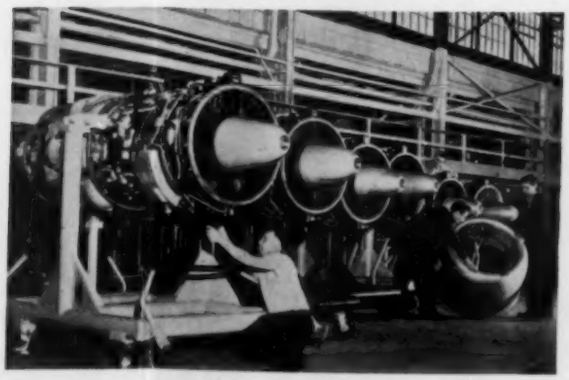


Designed and developed by Avro Canada, the famous Orenda Gas Turbine is in quantity production to power the CF-100. It is also installed in Canadian-built Sabre 5's.

Jet transport development was pioneered in North America by Avro Canada. This company designed and built the Avro Jet liner—the first jet powered transport to fly on the North American continent.

1916. SOPWITH PUP

1916. SOPWITH CAMEL

1920. AVRO BABY

1921. GLOSTER BAMEL

1922. GLO

K

1928. ARMSTRONG WHITWORTH AJAX

1928. GLOSTER GORCOCK

1929. HAWKER HORNET

1929–1940. HAWKER HART

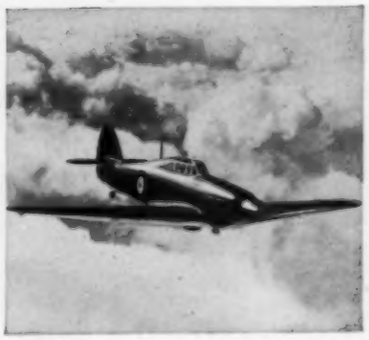
1929. GLOSTER VI SCHN

SCIMITAR

1935. HAWKER HIND

1936. GLOSTER GLADIATOR

1936. ARMSTRONG WHITWORTH WHITLEY



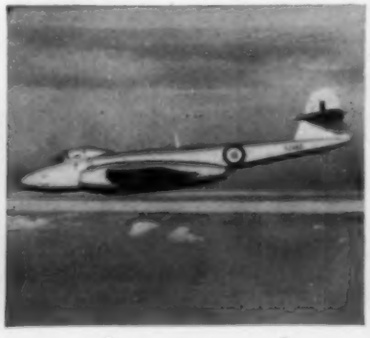
1937. HAWKER HURRICANE

1938. AVRO

1945. AVRO LINCOLN

1945. HAWKER SEA FURY

1946. GLOSTER METEOR 4



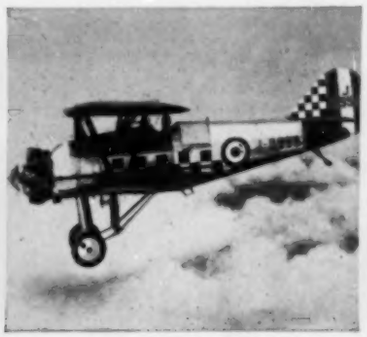
1948. GLOSTER METEOR 8

1949. AVRO

GLOSTER MARS VI

1923. GLOSTER GANNET

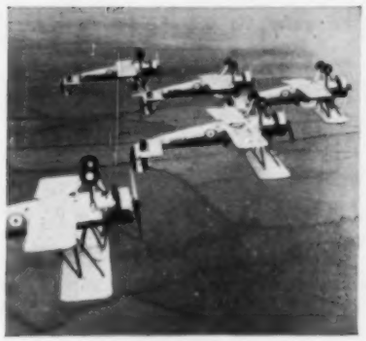
1924. HAWKER WOODCOCK



1925. ARMSTRONG WHITWORTH SISKIN IIIA

1925. ARMSTRONG WHITWORTH ATLAS

CHNEIDER TROPHY SEAPLANE



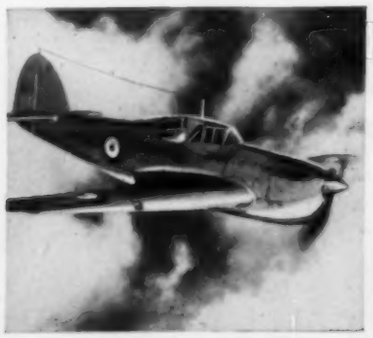
1929. AVRO TUTOR

1930. HAWKER OSPREY

1930. HAWKER FURY I

1931. HAWKER NIMROD

AVRO MANCHESTER

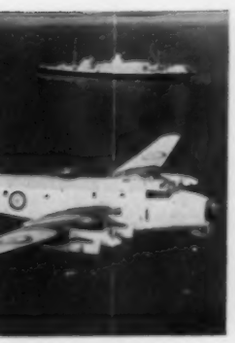


1938. HAWKER HENLEY

1938. HAWKER TORNADO

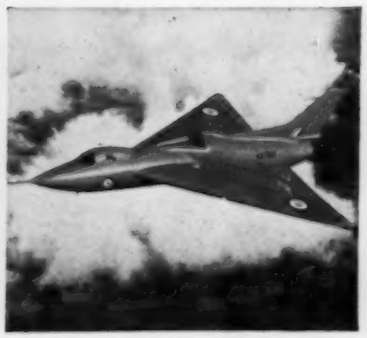
1938. ARMSTRONG WHITWORTH ENSIGN

1940. ARMSTRONG WHITWORTH ALBERMARLE



AVRO SHACKLETON

1949. ARMSTRONG WHITWORTH APOLLO



1950. AVRO 707B

1950. AVRO ANSON 20

1950. AVRO ASHTON

1920. AVRO BABY

1921. GLOSTER BAMEL

1922. GLOSTER MARS VI

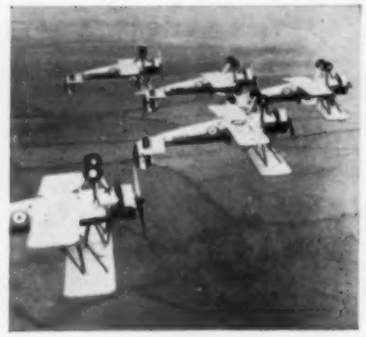
1923. GLOSTER GANNET

1924. HAWKER WOODCOCK

1929. HAWKER HORNET

1929–1940. HAWKER HART

1929. GLOSTER VI SCHNEIDER TROPHY SEAPLANE

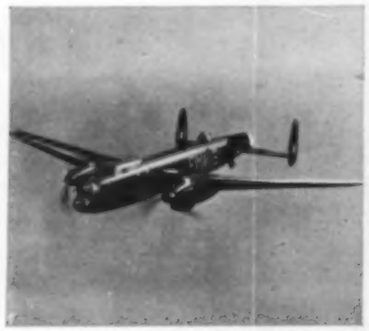


1929. AVRO TUTOR

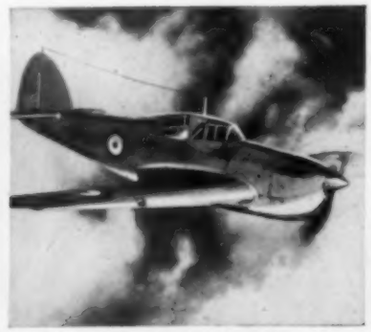
1930. HAWKER OSPREY

ARMSTRONG WHITWORTH WHITLEY

1937. HAWKER HURRICANE



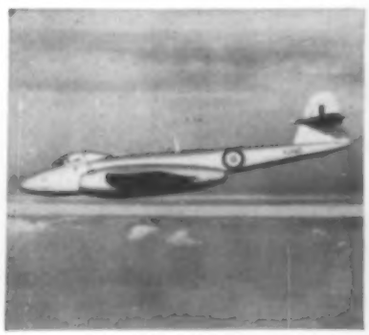
1938. AVRO MANCHESTER



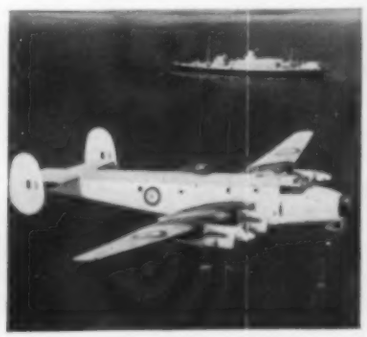
1938. HAWKER HENLEY

1938. HAWKER TORNADO

1946. GLOSTER METEOR 4



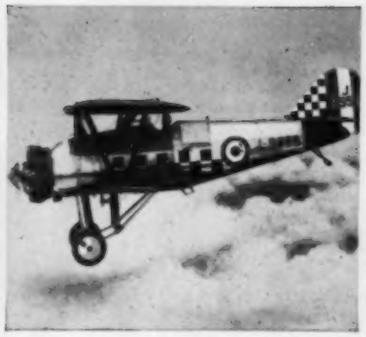
1948. GLOSTER METEOR 8



1949. AVRO SHACKLETON

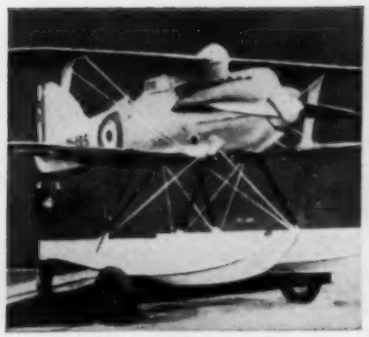
1949. ARMSTRONG WHITWORTH APOLLO

1950. AVRO 707B



1925. ARMSTRONG WHITWORTH SISKIN IIIA

1925. ARMSTRONG WHITWORTH ATLAS



1925. GLOSTER IIIA AND B

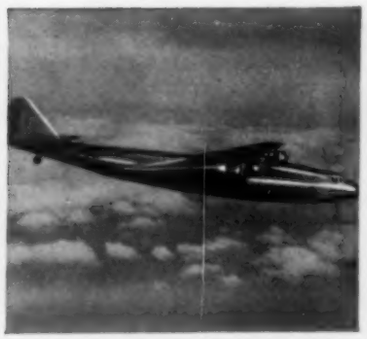
1926. AVRO AVIAN

1930. HAWKER FURY I

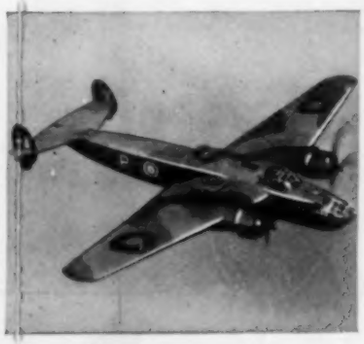
1931. HAWKER NIMROD

1932. AVRO CLUB CADET

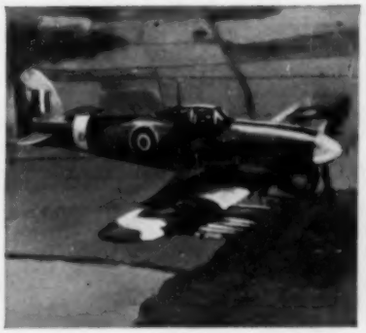
1932. ARMSTRONG WHITWORTH ATALANTA



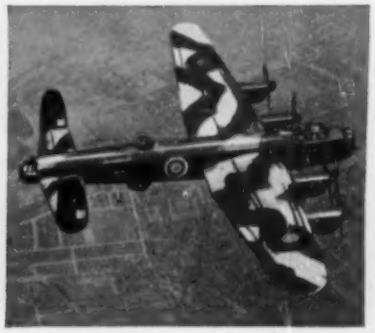
1938. ARMSTRONG WHITWORTH ENSIGN



1940. ARMSTRONG WHITWORTH ALBERMARLE



1940. HAWKER TYPHOON 1B



1941. AVRO LANCASTER

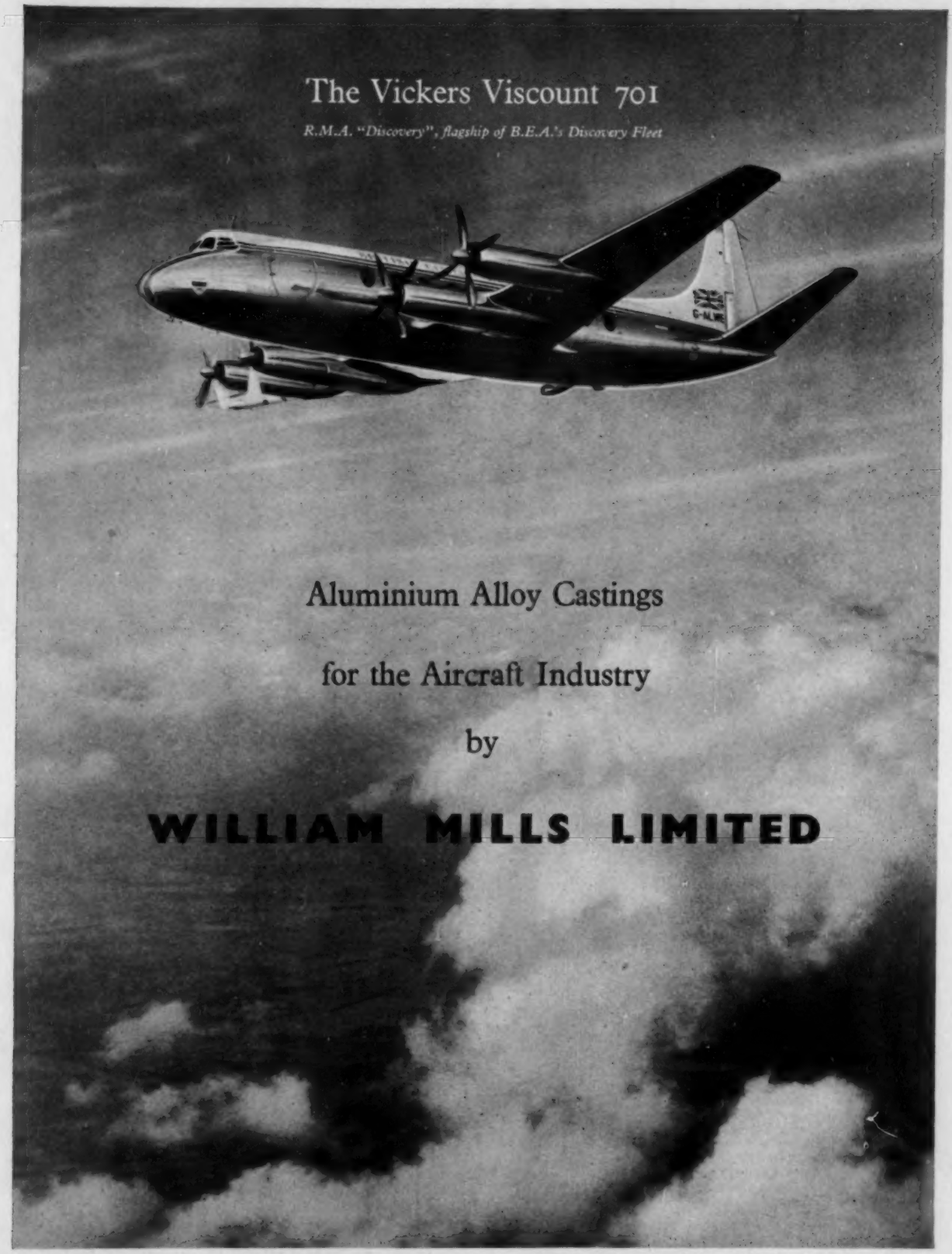
1950. AVRO ANSON 20

1950. AVRO ASHTON

1950. ARMSTRONG WHITWORTH NF11

1953. ARMSTRONG WHITWORTH N.F.14

CONTINUED OVERLEAF ▶



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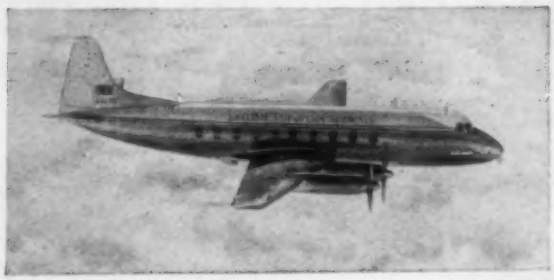

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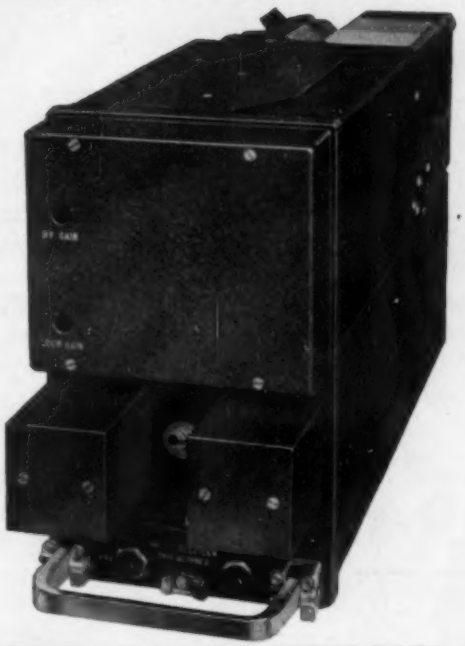

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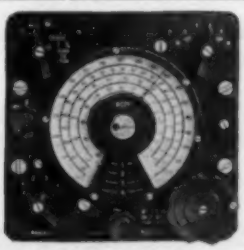
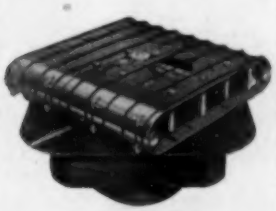


RECEIVER CONTROLLER



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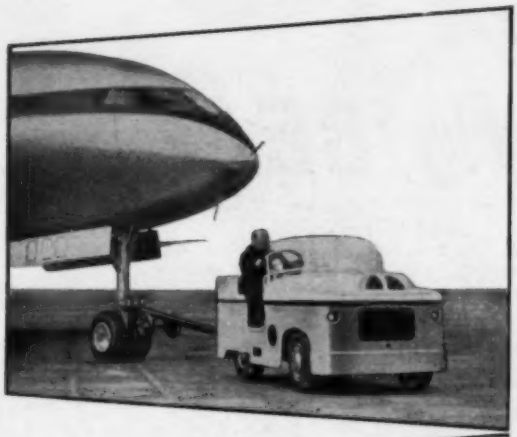

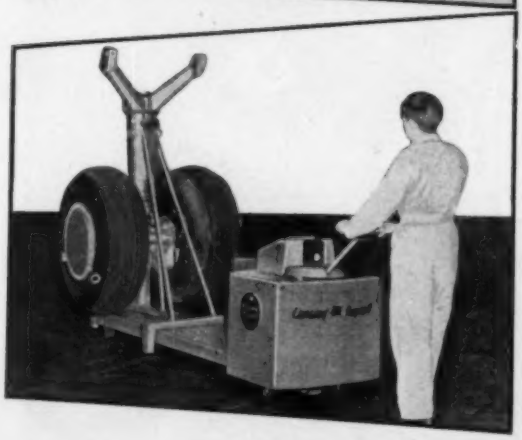

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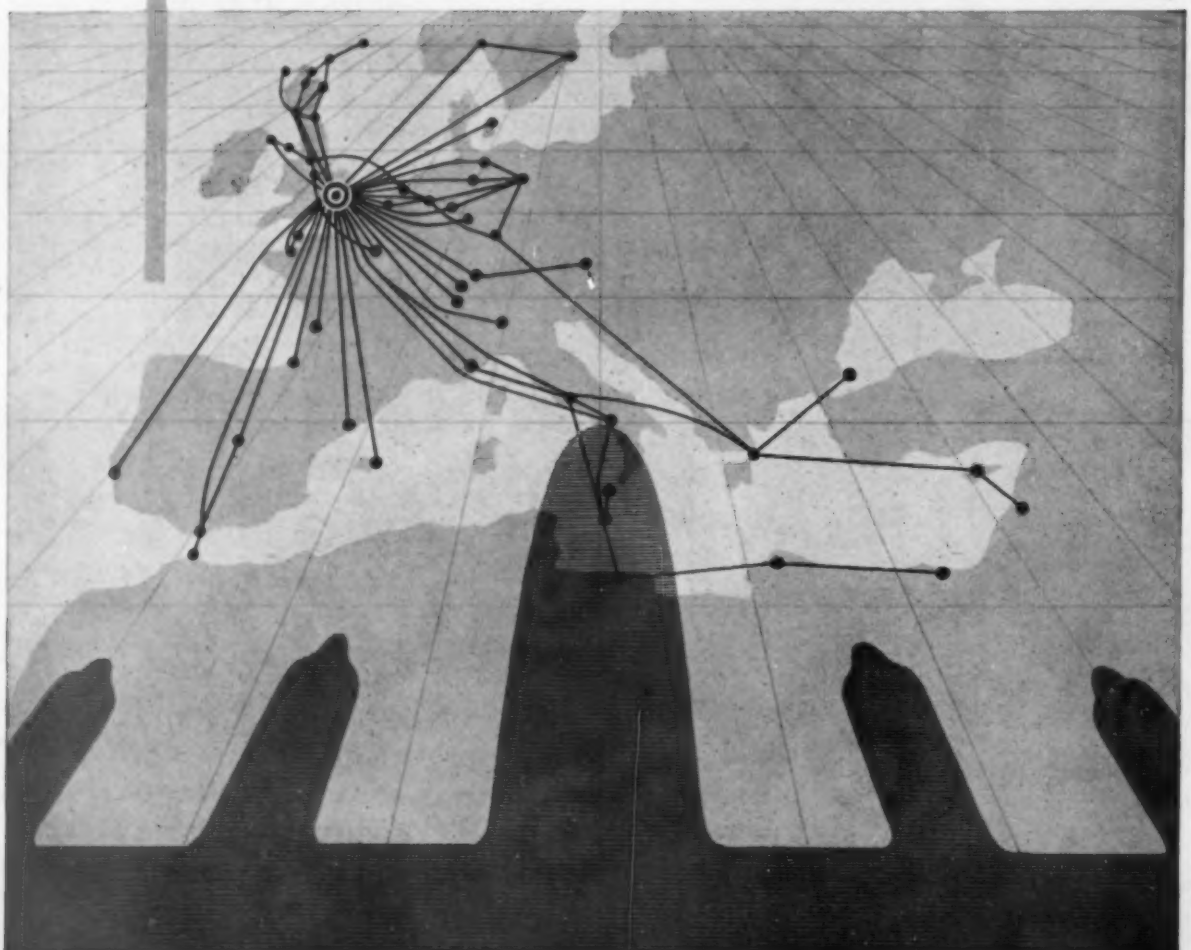

B R I T I S H E U R O P E A N A I R W A Y S

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The Year's Climax

ONCE again it is the first week of September, the great marquees are up at Farnborough, caravans are converging upon the airfield, and the British aircraft constructors are ready to welcome and entertain guests from many nations and distant lands. In the factories and flight hangars up and down the country painting and polishing, adjustment and testing are going on without respite in order to have the latest and best ready to display—within the confines of security.

Can it really be time for the S.B.A.C. Show again? people are asking. Certainly twelve months seem to have passed very quickly, but a great deal has happened in the time. Frankly, it has not been the best of years for British manufacturers. There have been too many cases of loss or serious damage to prototypes and of late deliveries of very important machines and equipment. But fortunately there have been some outstanding events which have gone far towards offsetting the disappointments.

In the field of commercial aviation the disasters which beset the Comet 1 early in the year have hung heavily over us all: it had been hoped that definite causes would have been ascertained by this time; but although much has been learned, thanks to the Royal Aircraft Establishment and to a remarkable feat of salvage by the Royal Navy, it seems that we must be patient for a little longer yet. Nevertheless, work has gone on without much delay on the new Avon Comet 3 prototype which will be seen in flight for the first time.

Extraordinary success has marked the efforts of those concerned with the sale of Viscounts. In many countries, including the United States of America, unstinted praise has been given to this versatile, speedy, economical and comfortable airliner and to its Dart turboprop power. To have obtained a large American order in addition to those from Canadian, Australian and many foreign operators is indeed a fine and heartening achievement.

That British manufacturers intend to follow up this success story with others may be judged from the progress made with several new transport designs, especially the Britannia, Herald and Twin Pioneer, each of which is in a class entirely of its own.

New military aircraft also present a bright picture; two very different fighters—the P.1 and the Midge—have recently made their first flights, and of these the P.1 has already substantially exceeded the speed of sound in level flight and without the aid of reheat. The Gnat, of which the Midge is a low-powered prototype, will likewise be supersonic on the level.

Whether or not the P.1 will fly over Farnborough remains to be seen. For our part we can see no point in putting such a "security clamp" on a machine once it is flying and photographs and drawings have been published. Keep it above 500ft and operate from another airfield by all means, but allow it a few seconds in which to flash by overhead. We may add also that we agree with those companies who see no point in a trade ruling which prevents new aircraft appearing at the Paris Show unless they have made a prior appearance at the S.B.A.C. Display. The idea, surely, is to give the best possible showing to the latest products of our industry—as and when they become ready.

Readers may recall a recent leading article on the subject of British gas turbines. We gave reasons for believing that the lead over the rest of the world is being maintained. It would now be possible to make an even stronger case as a result of the first announcement of some details of new units such as the Soar, Orpheus, Oryx and of so far unnamed turboprops from Filton and Derby.

But the intention of an exhibition and display is to give everyone a chance to judge for himself. Therefore we extend a warm welcome to all the guests of the British aircraft industry and hope that each will have a pleasant and profitable visit. May we mention in addition the guests of the Royal Aero Club International Invitation Air Rally chosen from among the many kind and hospitable friends who have looked after and entertained British private pilots on the Continent? May they, too, enjoy their stay in our country, which is to include a day at Farnborough. Several will no doubt be flying British light aircraft; should anyone be considering the purchase of a new machine he will find the trim little Aiglet alone representing the private-owner class at the Show.

FROM ALL QUARTERS

A Super-charged Turboprop

DESIGNATED B.E.25, the latest Bristol power unit is known as a supercharged turboprop. Intended for transport aircraft, it has an output of 4,000 h.p., which remains constant from sea level to considerable heights. Initiated as a private venture, the B.E.25 is now the subject of a Ministry of Supply contract.

Helicopter's 156 m.p.h.

SUBJECT to F.A.I. confirmation, the helicopter speed record is now back in the hands of the Sikorsky company (last year the 1949 Sikorsky record of 129.6 m.p.h. was raised to 146.7 m.p.h. by a twin-rotor Piasecki H-21). According to a U.S. Army announcement on Sunday a Sikorsky XH-39 has covered the three-kilometre course at 156.005 m.p.h.

American Friendships

PLANS for licensed production in America of the Fokker Friendship were announced last week by Mr. Richard S. Boutelle, president of the Fairchild Engine and Airplane Corporation. The Friendship is a short/medium-stage airliner designed to carry up to 36 passengers and powered by two Dart turboprops. Two prototypes are being built, and the first is due to fly next spring.

Mr. Boutelle was speaking at a luncheon given for Mr. Fritz Diepen and Mr. Ian Gerritsen of the Fokker Factory, who went to the United States to negotiate the agreement. He said that Capital Airlines' purchase of Viscounts had paved the way for commercial turboprop development in America, and added that negotiations were under way for production of Darts in America. The agreement with Fokker permits Fairchild to sell Friendships anywhere in the Western hemisphere except Brazil, where the Dutch company has a subsidiary.

Rolls-Royce in India?

ACCORDING to reports from India, negotiations are in hand for the establishment of a factory for the manufacture of Rolls-Royce engines in the Bangalore area, near to the Hindustan Aircraft plant. Mr. Vellodi, Secretary of the Defence Ministry, is visiting Derby to discuss the subject this week. The intention, it is said, is to begin work on the factory before the end of this year.

Rolls-Royce, Ltd., confirm that the matter is under consideration and it seems that Nene, Avon and Dart engines might be concerned, for overhaul and possibly for manufacture. Air-India International have placed an order for two Comet 3s powered with Avon turbojets and there have been long-standing rumours about impending orders for Viscounts (with Rolls-Royce Darts). Rolls-Royce at present have no establishment in India, their office for sales and representation closing two or three years ago.

Constellation Exchange

THE following announcement was made jointly by B.O.A.C. and Capital Airlines on August 26th: "With a view to standardizing their respective Constellation fleets, B.O.A.C. and Capital Airlines have agreed that B.O.A.C. will transfer their seven Constellation 049 aircraft to Capital Airlines in exchange for Capital Airlines' seven Constellation 749A aircraft. A financial adjustment is involved. The exchange will begin in October and will be completed by June 1955."

The "adjustment" referred to presumably implies a dollar payment by B.O.A.C. to Capital Airlines, since the Constellation 749As are of more recent construction than the 049s and have a better payload-range performance. Capital's willingness to part with the 749As no doubt results from the recent decision to standardize on Viscounts. The current market value of a Constellation 749A is rather more than £300,000, and that of an 049 might be 10-20 per cent less.

Aviation Honour for Mr. C. D. Howe

IT was announced in New York last week that the 1954 Daniel Guggenheim Medal is to be awarded to Mr. C. D. Howe, Canadian Minister for Trade and Commerce and Minister for Defence Production. The award will presumably be in recognition of Mr. Howe's notable record in co-ordinating and building up the aviation side of the Dominion's defence effort.

As Mr. Howe himself said in a special message in the Commonwealth Aircraft Industries number of *Flight* last week: "The Canadian aircraft industry has established an excellent record since Canada embarked on a defence preparedness programme at the time of the outbreak of hostilities in Korea. More than one thousand combat aircraft have been produced and a comparable number of high-powered turbine engines, in addition to utility and training planes. This effort has made available a considerable number of aircraft to the NATO forces, as well as completing the primary task of equipping the Canadian forces with up-to-date weapons."

The Daniel Guggenheim award, for contributions to aviation progress, is made each year by a joint committee of three American learned bodies, the Society of Automotive Engineers, the Society of Mechanical Engineers, and the Institute of the Aeronautical Sciences. The first recipient, in 1929, was Orville Wright; others have included Igor Sikorsky, General Doolittle and—last year—Col. Charles Lindbergh. Mr. Howe will receive the medal at the S.A.E. meeting in Los Angeles on October 8th.

Canadian as Air Ministry Scientific Adviser

BY agreement between the Ministers concerned, Dr. George Sydney Field, of the Defence Research Board of Canada, is being seconded for a tour of duty as Scientific Adviser to the Air Ministry.

It is by no means without precedent for United Kingdom scientists to fill scientific appointments in other parts of the Commonwealth and vice versa (says the Air Ministry, in announcing Dr. Field's appointment) and it is hoped that the present arrangement

TRANSONIC TRAINER is the appellation of North American's second, and improved, two-seat trainer variant of the F-86F Sabre. It has two 0.5in guns, provision for bombs or rockets, a dorsal fin, a ventral "keel" fin, and improved accommodation with raised seat for the instructor and folding head-rest for the pupil—both the two last-named mods. being to improve instructor-vision.

TOUGH BABY: In one of the first air-to-air pictures of the Folland Midge light-fighter prototype, the play of light and shadow accentuates the sweeping lines of this precursor of the Gnat. Though measuring only 20ft 8in in span, the Gnat will be armed with two 30 mm guns and be capable of supersonic speed on the level. Congratulations to chief designer W. E. W. Petter and test pilot S/L. E. A. Tennant, D.F.C. (left).

"Flight" photographs

will prove of benefit both to the United Kingdom and to Canada in the field of defence science.

Dr. Field was engaged in research on anti-submarine and anti-mine devices for the Royal Canadian Navy, and in 1951 he became Canada's Deputy Director-General of Defence Research. He is a Fellow of the Royal Society of Canada and a Senior Member of the Institute of Radio Engineers. He has written numerous articles on ultrasonics, vibrations in solids and electrical waves.

Dr. Field, who will be taking up his appointment next month, succeeds Dr. R. Cockburn, C.B., who was appointed Principal Director of Guided Weapons at the M.o.S. earlier this year.

Polish Air Day

POLAND celebrated her air day with displays in the main cities and towns on August 22nd. Writing in *Zolnierz Wolnosci*, the organ of the Polish Army, General Jan Turkiel, C-in-C. of the Polish Air Force, claimed that "together with the Polish Army the Polish People's Air Force has grown in strength and raised its battle preparedness." He thanked the Soviet Air Force for its aid in training Polish airmen, and then went on to claim that Poland now has "the most up-to-date aircraft and aerial weapons at her disposal," and that the Government is doing everything it can to promote the development of the Polish aircraft industry. A broadcast over Warsaw radio by Major General of the Polish Air Force Kadazanowicz (who, like the C-in-C., is a Russian citizen in Polish uniform) claimed that "never before had Poland such a strong air force as today," and that "never before has the Polish Air Force had such excellent, up-to-date equipment as today."

Service Gliding "At Home"

A POLISHED demonstration of sailplane aerobatics by Geoffrey Stephenson, British national gliding champion, in an Olympia, formed one of the highlights of No. 143 Gliding School's "Open Day" at Kenley R.A.F. station on Sunday last. More alarming was the demonstration of what a Primary can do when released from an aero-tow at 1,000ft-plus, a stirring performance preceded by Prefect aerobatics by P/O. "Micky" Gilbert, W.R.A.F., one of the school's instructors, in a Prefect—with radio commentary from the cockpit.

In between training and demonstration flights with A.T.C. cadets in T.21B Sedberghs and T.31 "Cadet Mk 3s" (as Tandem Tutors are known to the Service), the afternoon's only powered-aircraft display took place—a vigorous show by F/L. Jones from Detling in a Chipmunk. Power assistance on aero-tows had, incidentally, been provided throughout by an Auster of Kenley-based 661 A.O.P. Squadron, R.Aux.A.F. A simultaneous "formation" winch-launch by two Sedberghs completed the display.

In the evening, a colour film of A.T.C. gliding, made by instructors and cadets of the school, was shown. Although the success of the flying display was due to the good teamwork between instructors and cadets, much credit for both the film and the open day must go to the commanding officer of 143 G.S., F/L. C. Mackenzie-Lowe.

The 1954 Air Racing Champion

BY virtue of her victory last Saturday in the Goodyear Trophy Race, Miss Freydis Leaf becomes British Air Racing Champion for 1954—and the first woman to hold the title. Before the event she held 56 points and her nearest challenger was Nat Somers, with 50 points; in Saturday's race the latter pilot was placed fifth, so Miss Leaf gained possession of the championship by a comfortable margin; in the final marking she had 78 points against the runner-up's 64. Miss Leaf's successes during the season have been gained on her Hawk Major G-ACYO, while Somers has flown his Gipsy Major Gemini.

Third, fourth and fifth in the championship table, with the aircraft they have flown in the majority of the events, are: H. ("Tim") Wood, Messenger, 61 points; W. P. Bowles, Gemini, 45; and Ron Paine, Hawk Speed Six, 42. Other placings and marks include: 6, F. Dunkerley (39); 7, G. C. Marler (37); 8, A. J. Spiller (34); 9, P. Blamire and G. R. I. Parker (32, tie); 11, T. G. Knox (26).

A.V-M. for Martin

HAVING retired from the R.A.F. last year at the age of 48, A.V-M. Alfred C. H. Sharp, C.B.E., D.S.O., A.F.C., has joined Martin Aircraft, of Baltimore, to assist in the study and development of foreign markets. He became a pilot in the R.A.F. in 1924. During the war he served as deputy director of organization and planning at the Air Ministry, as deputy chief of staff to the commander of the U.S. Eighth Air Force in England, and later he commanded No. 54 Pathfinder base here.

Australian D.M.E.

SINCE a reference was made in an article "Across Three Oceans" (*Flight*, August 6th) to Australian Distance Measuring Equipment as used by Qantas on their Indian Ocean Wallaby service, more information has been provided by the manufacturers. Amalgamated Wireless (Australasia), Ltd., have supplied their 200 Mc/s D.M.E. equipment to other operators in Australia in addition to Qantas, and examples of the airborne components are to be shown on the Marconi stand at Farnborough.

The Australian system uses double-pulse interrogation and thereby gains two important advantages over the single-pulse systems: only one transmitting and receiving frequency is required, and the system discriminates against interference by noise, thus gaining in reliability and traffic handling capacity. As many as fifty aircraft can be handled by each ground station without saturation. (Incidentally, the reference in our article to I.C.A.O.'s 100 Mc/s D.M.E. should, of course, have read 1,000 Mc/s.)

The double-pulse airborne equipment is simplified; it has an output power of 400 watts and twelve channels are obtained by variation in pulse spacing. The weight complete is 50 lb and the current consumption is 8 amps at 28 volts.

"Flight" photograph

MISS FREYDIS LEAF, the new British Air Racing Champion (see news item on this page) is aviation adviser to the Women's Junior Air Corps.

RACE DAY AT SHOREHAM

SHOREHAM-BY-SEA lived up to its bright, breezy name on Saturday, producing fine weather for the last event in the 1954 air-racing calendar—the Goodyear Trophy Race—and the supporting features. The main event was won narrowly by Miss Freydis Leaf, whose Hawk Major not only brought her victory in the race but also in the 1954 British Air Racing Championship. Hers was a popular win, and a fair reward for a season of keen and consistent sportsmanship.

The pre-race scene was unusually quiet. By Friday afternoon most of the competing aircraft were paraded for handicappers' inspection, including the all-white Sparrowjet, which was prevented by starting trouble from competing for the King's Cup. A peep inside the Sparrowjet's neat bubble canopy was rewarded by the discovery that its placarded "never-exceed" speed is 250 m.p.h.; 200 m.p.h. is given as the normal cruising speed, and the stall occurs at perhaps the lowest speed of any fixed-wing jet aircraft—52 m.p.h. Its owner, Fred Dunkerley, entered both the Sparrowjet and his familiar Cirrus-Gemini for the Goodyear Trophy, flying one in each heat. His Mew Gull, also painted all white, now sports a new, domed canopy offering much improved visibility to its pilot—on this occasion, P. Clifford.

There were nine starters in the first heat and eight in the second, each heat consisting—as did the final—of four laps of a 15-mile quadrilateral circuit. Nearly 23 minutes separated the first and last starters in heat one—L. Atherton's Piper Cub and the Mew Gull. Not until the Cub had completed more than two laps was the sleek Mew, looking every inch a racer, permitted to speed off in pursuit of the field. Meanwhile, there had been no significant developments, though Freydis Leaf's Hawk Major, third away, appeared to be gaining on A. J. Spiller's Messenger. The blue Gipsy-Gemini of Nat Somers took off only 29 seconds after Dunkerley's Cirrus model and caught up with it at the end of the first lap. Very soon afterwards Dunkerley dropped out with suspected lack of oil pressure in one engine. Miss Leaf romped away with this heat, with Spiller and Somers well back in second and third places. The handicapping seemed less than fair to the Mew, which just secured a place in the final by coming in sixth behind G. C. Marler (Falcon) and A. S. Paine (Proctor).

Scratch man in the second heat was J. M. Donald (Tiger Moth); Dunkerley was back marker in the Sparrowjet with a 17 min 24 sec handicap. By the end of Dunkerley's second lap there had been only one change in position: "Tim" Wood's Messenger had passed the similar but slightly slower aircraft of E. W. Westbrook. He was unable to catch the Tiger Moth, however, which won the heat quite comfortably. Ron Paine moved up from seventh to third place in his Hawk Speed Six, and was followed in by Walter Bowles, the Sparrowjet, and D. and D. W. Phillips (Proctor). We were sorry to see that Capt. Jan Christie of S.A.S. was unable to secure a place in the final with his Globe Swift LN-BDE. One feels that a pilot who flies from as far afield as Stockholm to take part in British air racing merits a less discouraging handicap.

The six fastest aircraft in each heat made up the field for the final, which was delayed while frantic efforts were made—successfully—to replace a burst tyre on the Sparrowjet. Donald's Tiger Moth started at scratch, and the Mew Gull was back marker, taking off 18 min 3 sec later. An interesting feature of the start was that the Sparrowjet received a more favourable handicap (17 min 54 sec) than its piston-engined stablemate. At first this concession seemed to be justified; the Mew overhauled the Sparrowjet on take-off, and quickly established a 400 yd lead. For most of the race the two were neck and neck. Lap-by-lap progress gave little clue as to the outcome of the event. The first aircraft to appear was Donald's Tiger Moth, with Spiller's Messenger maintaining second place behind it.

Perhaps the most attractive entrants in the Goodyear Race were the Mew Gull, with its new canopy (left), and the Sparrowjet (top, right). Both averaged over 200 m.p.h. Above, Freydis Leaf's victorious Hawk Major takes off to win the Goodyear Trophy. "Flight" photographs

But Miss Leaf's Hawk Major came up fast on the home stretch, and nosed ahead to win. A short pause, and then the rest of the field swept overhead in a tight bunch. The Mew Gull, alas, was last but one, despite Clifford's spirited handling and an average speed of 205 m.p.h. The Sparrowjet took seventh place at 210 m.p.h.

A rousing finale was provided by the five "Throttle Benders" who took part in the Southern Aero Club Invitation Race. On this very short round-the-airfield course, the competitors were visible the whole time, which is ideal for the spectator. The race was restricted to experienced pilots and the 200 m.p.h.-plus duel between the Mew and the Sparrow was most exciting. The Mew, starting scratch, had picked up its handicap on the take-off and scatter alone, due to its greater acceleration, but it had just about lost it again to the jet by the end of the first lap. Somers seemed in his element as he peeled his Gemini steeply off each short straight leg on to the next, managing to keep ahead of the scratch men and finally overhauling the rest to dive over the line in first place.

The supporting air-display items were few in number but of first-rate quality. The capabilities of the Westland-Sikorsky S.51 helicopter were demonstrated at suitable intervals by the *Evening News*, Silver City Airways and H.M.S. *Peregrine* (R.N.A.S. Ford). Major "Dumbo" Willans of the G.Q. Parachute Co., performed a ten-second free fall before making use of the new, highly controllable "blank-gore" canopy developed by his firm for the recent World Parachuting Championships. In the Auster Aircraft company's latest demonstration Aiglet, test pilot Ranald Porteous ran through a complete "Farnborough" programme, including a particularly indescribable flick roll at the top of a loop (if his now-famous "avalanche" can be so defined). Loud clapping expressed the delight of the crowd. Another aerobatic classic was the Meteor 8 demonstration by S/L. Max Scannel, who extracted the last ounce of thrust from his Derwent 8s and a surprising amount of condensation from the seemingly dry, sunny air.

GOODYEAR TROPHY RACE

Pl.	Pilot	Aircraft	Speed (m.p.h.)	Start Pos'n	Handicap min. sec.
1	Miss F. Leaf	Hawk Maj. G-ACYO	139.5	4	08 27
2	J. M. Donald	Tiger Moth G-AIVW	105.5	1	00 00
3	A. J. Spiller	Messenger G-AKIN	129.5	2	06 30
4	H. Wood	Messenger G-AKBO	131.5	3	07 14
5	J. N. Somers	Gemini G-AKDC	172	9	13 54
6	G. C. Marler	Falcon G-ADTD	166.5	8	13 15

SOUTHERN AERO CLUB INVITATION RACE

Pl.	Pilot	Aircraft	Speed (m.p.h.)	Start Pos'n	Handicap min. sec.
1	J. N. Somers	Gemini G-AKDC	158.5	3	2 11
2	G. C. Marler	Falcon G-ADTD	153	2	1 45
3	F. Dunkerley	Sparrowjet G-ADNL	185.5	5	3 58
4	W. P. Bowles	Gemini G-AKDK	131	1	0 00
5	R. R. Paine	Hawk Spd. Six G-ADGP	166.5	4	3 11

BEST-SELLER: As reported below, Viscount orders have now passed the 150 mark. The 17 customer-airlines include British West Indian Airways, whose new livery is displayed here on the prototype Viscount 700, G-AMAV.

CIVIL AVIATION

MORE VISCOUNTS FOR CANADA

ALTHOUGH delivery of Viscounts to Trans-Canada Airlines is not due to begin until the end of the month, the company has already shown its confidence in the British turboprop airliner by increasing the number ordered from 15 to 18. In addition, the Canadian airline has expressed its intention of ordering four more. The total of Viscounts firmly ordered is thus increased to 149 (or 153 including the four aircraft covered by T.C.A.'s letter of intent). With initial spares provision the seven extra T.C.A. Viscounts are valued at £2m ($5½m). The first two T.C.A. Viscount 724s are approaching completion in the Vickers-Armstrongs erecting shop at Weybridge; remaining aircraft will be built at Hurn. Fitted out as 48-seaters, the Canadian Viscounts will operate on inter-city routes within Canada and between Canada and the United States, including such important services as the Montreal - Toronto - New York triangle and the Toronto - Chicago route.

The total value of Viscounts firmly ordered has now reached £44m, consisting of £12m in home orders and £32m in exports. Dollar orders—for Capital Airlines' 40 Viscounts and T.C.A.'s 22—are valued at $62m (£21.8m).

QANTAS APPOINTMENT

ON completion of a tour of duty lasting a little over two years, Capt. L. R. Ambrose is returning to Sydney. His place as London manager for Qantas Empire Airways will be taken by Capt. Russell B. Tapp, a Bristolian by birth who gained his R.F.C. wings in 1917 and joined Queensland and Northern Territorial Aerial Service (the original Qantas) in 1928. After commanding D.H. 86 services on the Brisbane - Singapore section of the Empire route, Capt. Tapp transferred to flying-boats, on which he made some notable flights during the war. Early in 1941 he made a 3,200-mile non-stop journey by Catalina from Canton Island to Sydney; his navigator on that occasion was Capt. P. G. (now Sir Gordon) Taylor. In 1943 Capt. Tapp commanded the first Catalina flight between Ceylon and Perth, thus inaugurating Qantas operations over the Indian Ocean. The achievements on the Indian Ocean route were recognized by the award of the Johnstone Memorial Air Navigation Trophy for 1948, which Capt. Tapp received jointly with his predecessor in London, Capt. Ambrose.

SUPER-CONSTELLATION TIP TANKS

THE Lockheed Super Constellation (L.1049G version) is likely to be the first long-range airliner to carry wing-tip fuel tanks. Type 700D Viscounts will have leading-edge "slipper" tanks; the DC-7B has nacelle-mounted "saddle" tanks; and the prototype Comet 3 is flying with "pinion" tanks. The Super Connie's wing-tip tanks, increasing fuel capacity from 6,550 to 7,550 (U.S.) gallons, will add 850 miles to the still-air range (with reserves) of 3,770 miles.

Other features of the L.1049G include provision for fitting cloud-warning radar (as ordered by T.W.A.); the installation of 3,250 h.p. Wright DA3 Turbo-Compound engines, each developing 100 h.p. more climb power than the DA1s now fitted; and improved sound-proofing. Air France, K.L.M. and Lufthansa are among operators with L.1049Gs on order, and a similar aircraft is being prepared as a private transport for President Eisenhower.

BREVITIES

VISCOUNTS will operate nearly all the European services of Air France during the coming winter. The 12 new turboprop airliners will replace DC-4s on most routes, with the exception of Paris-Prague and the German internal services; one DC-4 service between London and Paris will be continued. Viscounts will fly four return services daily from London to Paris and two weekly from Manchester to Paris.

* * *

The strike of American Airlines' pilots, which began on July 30th, was settled on August 22nd. Under the terms of the settlement, the company will continue to operate its DC-7 non-stop transcontinental services; but its contract with the Air Line Pilots' Association will be amended to provide that crews "will not be assigned to fly more than eight scheduled hours on flights with one or more intermediate stops."

* * *

Considerable increases in traffic during the first half of 1954 are reported by Swissair. The number of passengers carried on all routes increased by 35 per cent to a total of 237,513, and both freight and mail traffic went up by 23 per cent. The average load factor, however, dropped from 66.5 to 57.9 per cent, against an increase of 61 per cent in capacity offered.

* * *

The new Minister of Transport and Civil Aviation, Mr. J. A. Boyd-Carpenter, has appointed Mr. O. F. Gingell and Mr. S. M. A. Bannister as his joint principal private secretaries.

* * *

The first of three new Convair 340s ordered by Ansett Airways completed its delivery flight from San Diego to Melbourne on August 16th. The aircraft, which is reported to be a high-density version accommodating 56 people, will enter service late this month.

* * *

Iberia joined the ranks of transatlantic airlines on August 26th, when the company operated its first Super Constellation service from Madrid to New York. The three new Iberia Super Connies will operate three return services weekly on this route.

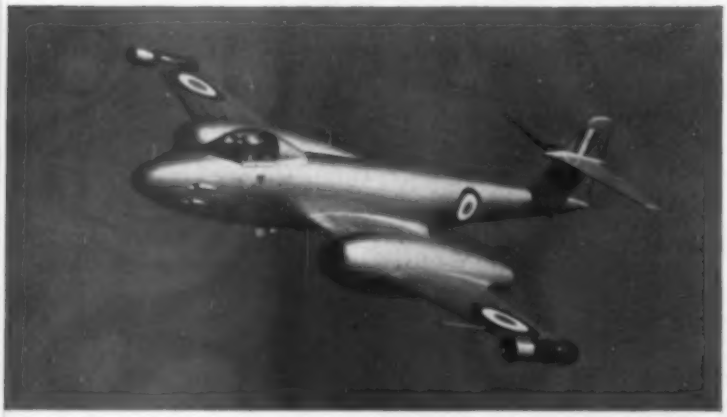
BACK AT WORK: Airworthiness flight-trials with the Britannia 100 prototype have lately been resumed. In this fine study, the aircraft is seen over the main Gloucester road on final approach to the runway of the Bristol Company's airfield at Filton.

"Flight" photograph

The Folland Midge pictured a few days ago on a flight from Chilbolton. In 13 days it logged nine hours and made 30 take-offs and landings.

HEADLINES AND SIDELINES

Pre-Farnborough News and Views of British Aircraft



FEATURED in this year's pre-Farnborough assembly of releases and disclosures are the Folland Midge light fighter prototype, a Meteor with Rolls-Royce Soars, a Canberra with Armstrong Siddeley Sapphire 7s, a Varsity with Napier Elands (these three are flying test-beds), the latest development of the Hunting Percival Jet Provost trainer, a new version of the Saunders-Roe Skeeter light helicopter, and the Handley Page Herald transport, now under construction.

Powered with an Armstrong Siddeley Viper, the Folland Midge is externally almost identical with the Gnat (Bristol Orpheus), but whereas on the Midge the ailerons are of conventional type, without power assistance for the pilot, they will be mounted inboard on the Gnat and will be power-operated. Folland Aircraft, Ltd., announce that the Gnat, the first prototype of which should be ready for flight in about a year, will ultimately be supersonic in level flight, and that twenty fully equipped machines of the type could be bought for the price of six "standard" fighters. They stress also the

(Above) The Rolls-Royce Soar-Meteor on a recent flight from Hucknall. (Below, left) Armstrong Siddeley's Canberra B.2, fitted with two of their new Sapphire 7 turbojets. (Below, right) A new study of the Hunting Percival Jet Provost, showing the fillets at the wing/intake junction and the long keel surface beneath the rear fuselage. Like the Midge, the Jet Provost is powered by an Armstrong Siddeley Viper.

ease with which the Gnat could be transported by air, ship or road, and the adequacy of its endurance for long-range ferrying when fitted with wing-tip tanks. The Midge, they add, has already proved the soundness of another claim for this class of aircraft—that maintenance time is low in relation to flying time; for whereas some fighters now in service need at least 100 man-hours of maintenance for every hour of flight, in the thirteen days following the first flight of the Midge nine hours' flying and thirty take-offs and landings were logged.

Details of the Bristol Orpheus turbojet, to be standardized for the Gnat, are still withheld, but Follands say that it is designed to give roughly three times the power of the Viper (1,640 lb thrust) for only a slightly greater weight and slightly larger diameter. Such, indeed, will be the thrust/weight ratio of the Gnat that it should have a rate of climb "better than that of any turbojet-engined contemporary."

The Rolls-Royce Soar-Meteor, as the picture discloses, is a standard Mk 8 airframe with a Soar mounted at each wing tip. Although less than 16in in diameter and weighing under 270 lb, each Soar develops over 1,800 lb of thrust. The Soar-Meteor will fly at Farnborough with the two Derwents switched off.

Armstrong Siddeley's Sapphire 7 Canberra is a test-bed for the latest Sapphire development, which though debarred from the static display, will be distinctly heard in the air.

Napier's Eland-Varsity is another standard airframe adapted for engine-development work; consequently, the nacelles are of vastly greater diameter than necessary, for the Eland has a diameter of only 36.1in.

Another picture shows that the Hunting Percival Jet Provost now has a fillet at the junction of mainplane leading edge and intake duct, and that a long, shallow, keel surface now runs beneath the rear fuselage.

The Saunders-Roe Skeeter Mk 6 is not illustrated, for one reason that photographs are not yet available, and for another that the machine is externally identical with the Mk 5. The engine is, however, the new de Havilland Gipsy Major 30, of over 200 h.p.

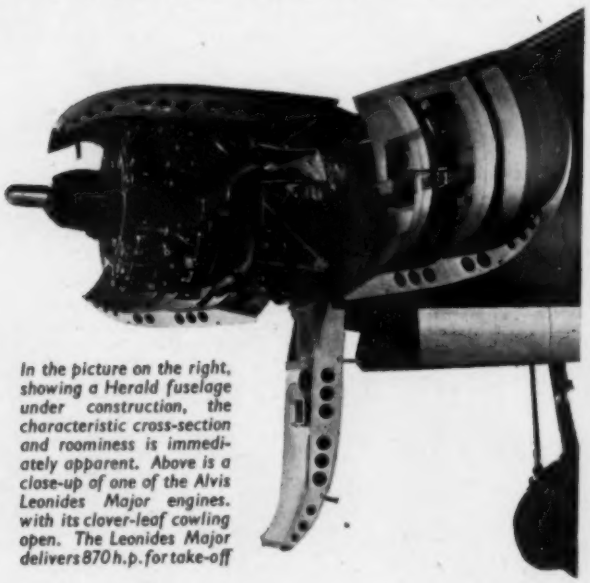
Finally we show a view of the first Handley Page Herald four-engined transport under construction. Formerly known as the H.P.R.3, the Herald is to be powered by four Alvis Leonides Major engines. Two prototypes are being built, and the first should fly next year. Meantime, the production line is being set up and, all being well, Heralds will be in service by 1957.

The Herald is planned for use as an airliner (with 36 first-class or 44 tourist passengers), as a combined airliner/freighter, or solely as a freighter. The high-wing layout was chosen for ease of loading and for comfort in hot climates, and the cabin is pressurized to a maximum differential of 2.35 lb/sq in—equivalent to a cabin altitude of 6,500ft. Air-conditioning equipment will supply at least 50 lb of fresh air per minute at 15,000ft. The Leonides Majors each deliver 870 h.p. for take-off and are enclosed in clover-leaf cowlings. They draw fuel from four bag-type tanks, of 700 gallons capacity, in the centre section, and an additional tankage of 300 gallons is optional, so that there will be no obligation by the short-range operators to utilize the aircraft with superfluous tankage and an unwanted weight penalty.

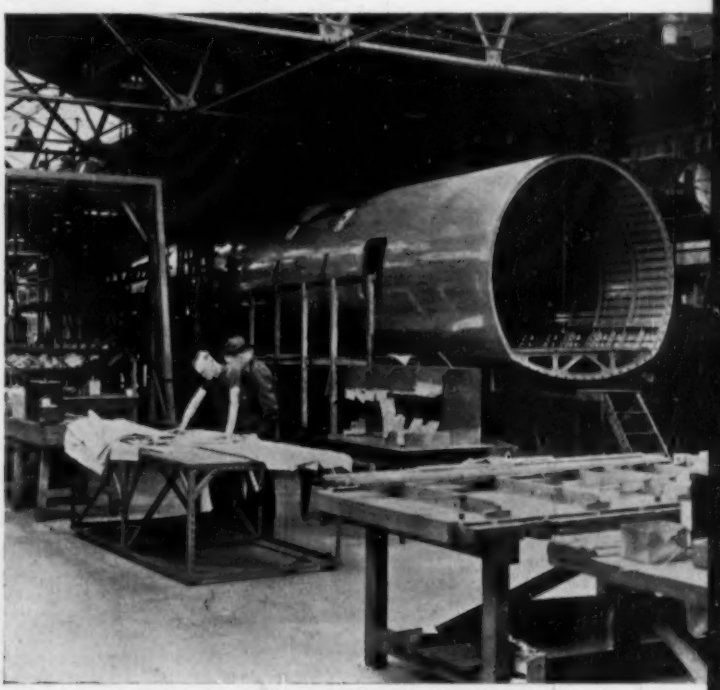
The makers say that piston engines are being used because they are preferred by the majority of operators whose aircraft must fly from small airfields with the minimum of facilities. Preparations have been made, however, for the possibility of "change in the present airline viewpoint of their suitability for short-range operations." A crew of two—captain and first officer/navigator—will be carried, but a radio operator can be accommodated if necessary. Flying controls and flight instruments are duplicated.

The all-up weight of the Herald will be 34,000 lb, and the cruising speed 200 m.p.h. at 50 per cent METO power. It will operate with safety from a 1,000-yd grass strip.

Napier's Eland-Varsity, our newest turboprop test-bed, photographed at Luton. The airscrews are Rotols, with solid-dural blades.



In the picture on the right, showing a Herald fuselage under construction, the characteristic cross-section and roominess is immediately apparent. Above is a close-up of one of the Alvis Leonides Major engines, with its clover-leaf cowling open. The Leonides Major delivers 870 h.p. for take-off



HERE AND THERE

Heli-ferry

THE new Westland-Sikorsky S-51 acquired by Silver City Airways took off from Lympne last Friday on the first of the series of cross-Channel proving flights for which the company has received M.T.C.A. approval. A freight service is to be inaugurated on April 1st next.

Yeager in Europe

THE first man to exceed the speed of sound, Major Charles ("Chuck") Yeager, has been posted from the U.S.A.F. Flight Test Center, Edwards A.F.B., California, to be staff operations officer at H.Q. 12th U.S.A.F., Ramstein, Germany.

Lockheed C-130 Flies

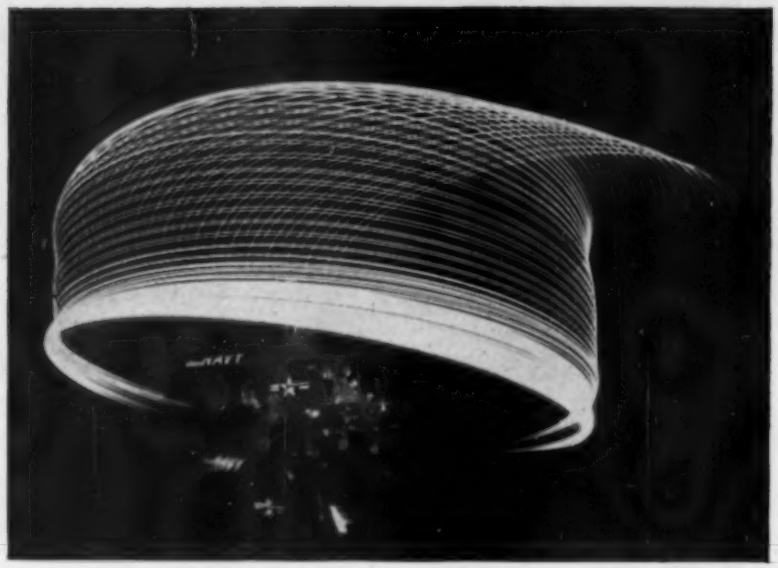
THE first military transport aircraft designed expressly for turboprop power—Lockheed's C-130, with four Allison T56s—made its first flight from the Lockheed Air Terminal, Burbank, to Edwards Air Force Base a few days ago. The pilot, Stanley Beltz, kept the new prototype airborne for 61 minutes.

CF-100 Accident—"Zura" Safe

AVRO CANADA test pilot Jan Zurakowski (formerly of Gloster Aircraft), escaped from a CF-100 all-weather fighter on August 24th when the machine caught fire over Toronto after what is described as an explosion. His flight observer, John Hiebert, is said to have fatally delayed his bale-out, having insisted on "throwing some secret equipment overboard" when the fire occurred. This equipment was recovered later not far from the spot where "Zura" landed. The accident, and Zurakowski's parachute descent, was witnessed by thousands of people, and a delegation is said to have thanked him for steering the aircraft away from populated areas.

New Chief Scientist

APPOINTED to succeed Sir Harold Roxbee Cox as chief scientist of the Ministry of Fuel and Power is Mr. K. T. Spencer, C.B.E., M.C., B.Sc.(Eng.), F.R.Ae.S., A.M.I.C.E. Between the wars Mr. Spencer was at the R.A.E., Farnborough, and in 1935 was transferred to the Air Ministry. In 1940 he went to M.A.P. and throughout the war was concerned with the expansion of aircraft research and development here and in the Commonwealth countries. Towards the end of the war he was seconded to the A.R.B. He was a member of the first Brabazon Committee, and in 1946 he established the Airworthiness Section of the provisional International Civil Aviation Organization in Montreal. He joined the Ministry of Fuel and Power in 1950.



WHIRLIGIG: This striking pattern was traced by lights on the tips of one rotor of a Kaman HTK-1 which took off, hovered and climbed away during a time exposure. The use of such lights is well established in helicopter research, but Kaman Aircraft and the U.S.N. Bureau of Aeronautics are investigating their possibilities as navigation lights.

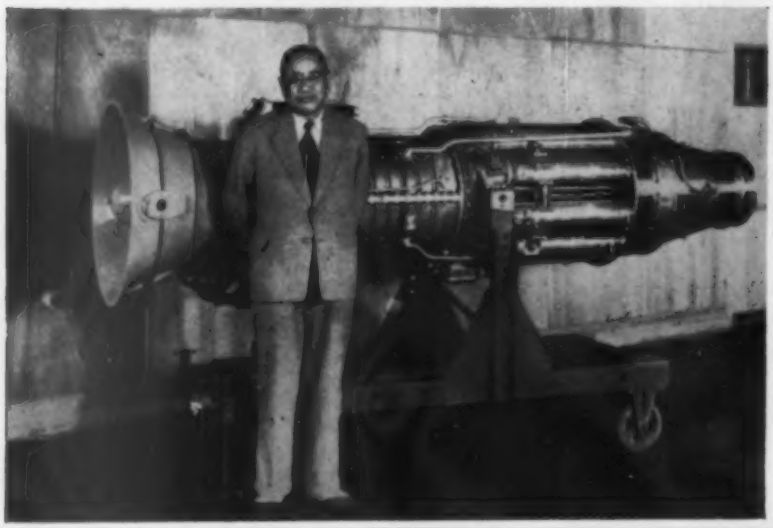
Poles Apart

IN the caption to a photograph illustrating an article on Polish gliding in our issue of July 23rd (page 107) the name Alexander Yrkevich should have read Alexander Manockow.

A Swift Lost

THE crash of an R.A.F. Vickers-Supermarine Swift near Thaxted, Essex, last week was taken as an indication that the type—temporarily grounded after a crash last May—is now back in squadron service. The pilot, from Waterbeach, used his ejector seat at 10,000ft and descended safely.

JAP JET: Basically an improved—and, we suspect, Americanized—version of the Ne-20 turbojet developed in Japan in 1944-5, the prototype JO-1 has been completed and may be run in "a few weeks." Here, Mr. Kita Kenji, president of Fuji Heavy Industries, is shown alongside; a brief description of the engine was given in our "Power Units" issue of April 9th last.



Beetle War

FIVE light aircraft have been lent by the Soviet Government to fight outbreaks of Colorado beetle in Hungary. They are to be used to spray insecticide over the infected area of potato fields.

R.C.A.F.'s London P.R.O.

AFTER three-and-a-half years as R.C.A.F. public relations officer in London, F/L. "Al" Marshall returned to Canada last week. He is succeeded by F/L. J. E. Palmer.

A New "Flight" Handbook

COMPLETELY rewritten and greatly enlarged in size and content, the fifth edition of *Flight Handbook* appears next week. Illustrated by 217 photographs and drawings, plus 12 large fold-out drawings of aircraft and engines, this 282-page handbook is designed to meet the needs of all who require basic information on the subject of aircraft, engines and the theory of flight. A study will provide valuable preparation for those entering aviation professionally; it will also assist the younger reader towards fuller understanding of the technical matter that appears in *Flight* each week. *Flight Handbook*, fifth edition, will be on sale next Monday, September 6th, price 15s, or may be ordered (postage 8d) from the publishers, Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1.

Guided-missile Progress

ANOTHER new edition of a *Flight* book appearing next Monday is the second of *Development of the Guided Missile*, by Kenneth W. Gatland, F.R.A.S. Although the first edition appeared only two years ago, progress in this field has been so rapid that an immense amount of new information is incorporated; for example, the table of characteristics which was an important feature of the first edition now provides data on no fewer than 140 rocket-powered missiles from eight countries. Price and publication details are identical with those quoted above for *Flight Handbook*.

England, so long the mistress of the sea,
Where winds and waves confess her sovereignty,
Her ancient triumphs yet on high shall bear,
And reign, the sovereign of the conquered air.

Gray *Luna Habitabilis* 1737

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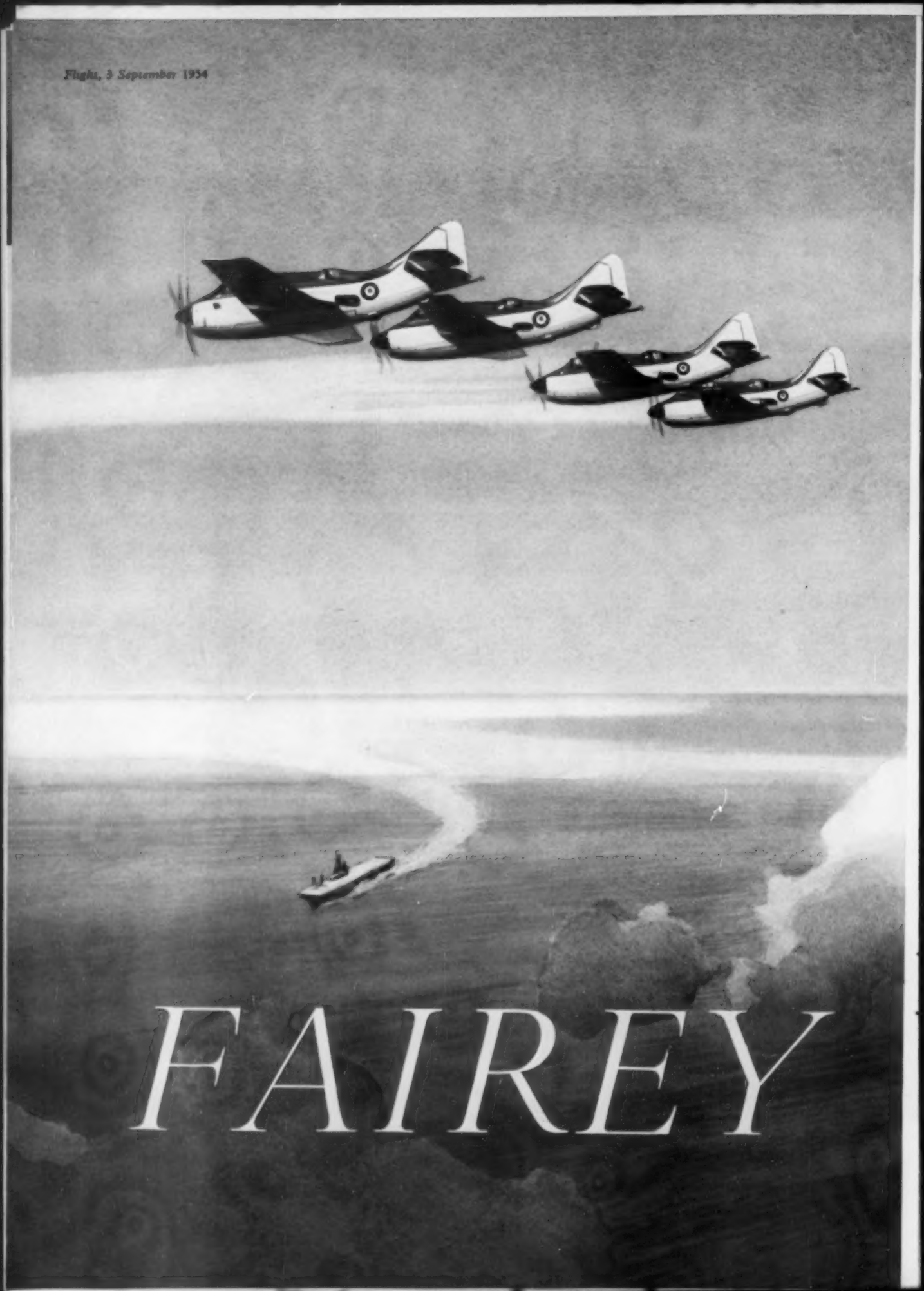
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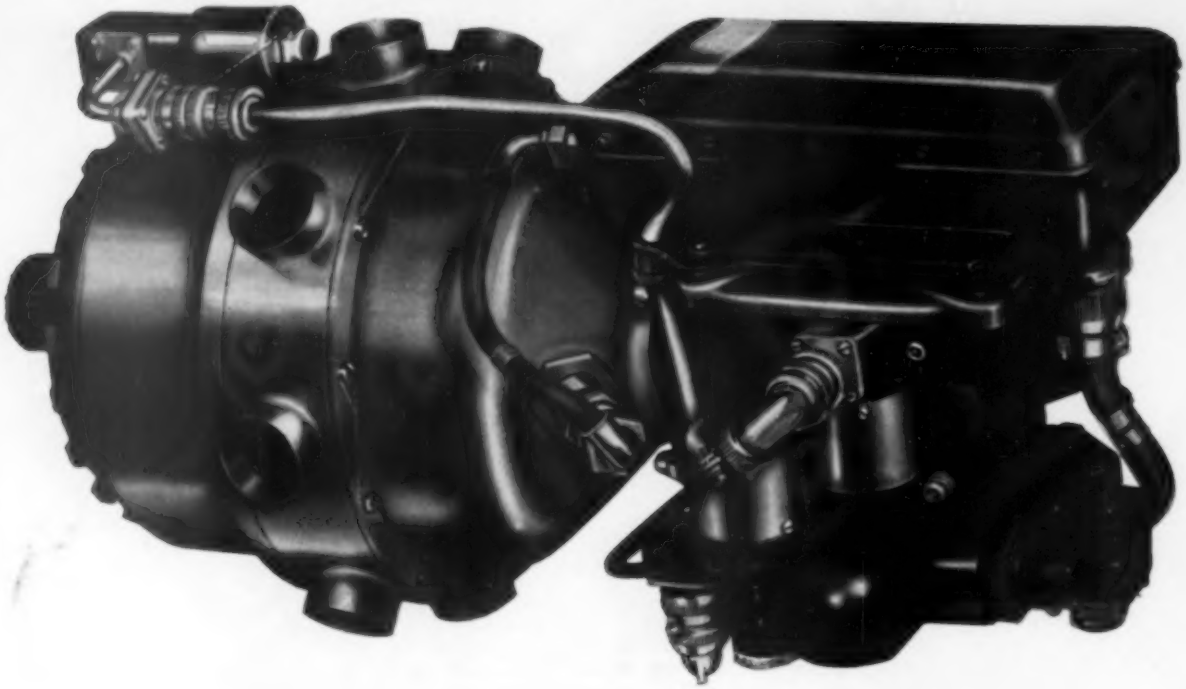

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BRITISH AIRCRAFT 1954

IF we in Britain are forbidden to wave the Union Jack for the annual Display of the Society of British Aircraft Constructors, then we may as well leave it furled for the rest of the year; for "Farnborough" (by the name of which airfield the display is known the world over) is the expression of our nation's will to lead in the air, to triumph over set-backs, and fulfil her destiny. So we shall wave the flag without shame; and the flag being a militant symbol—and British weapons having so far secured our survival—our fighting aircraft shall be our first concern.

Among these the massive English Electric P.1 and tiny Folland Midge (prototype of the Gnat) now take their places; and though they differ vastly in concept, if not in purpose, it is safe to predict that they will impress equally by their ingenuity of design and standards of performance. As for the now-familiar Supermarine Swift and Hawker Hunter day interceptors, and the long-range, all-weather Gloster Javelin, the testimony of the United States Air Force that these are "in the top flight" is sufficient; and though it is not permissible to support this generous assessment with actual performance data, it can be claimed with certainty and pride that the Swift and Hunter, with their armament of four 30mm Aden guns, deliver a far greater volume of fire than their foreign counterparts. It is reasonable to assume that the Javelin will not be despatched into storm and darkness to deliver a lesser punch.

Production of our four-jet medium "V" bombers—the Vickers Valiant, Avro Vulcan and Handley Page Victor—goes forward at an increasing rate, and the first Valiant squadron may be taking its place in the R.A.F. order of battle within a matter of weeks. And as the Valiants flow out to the squadrons, the Vickers Type 1000 strategic military transport, characterized by superb aerodynamic design and by the first installation of Rolls-Royce Conway by-pass turbojets, will emerge for trials. Likewise built to serve the armed forces, the Beverley "pantechnicon" of Blackburn and General Aircraft is capable of serving economically with any of a variety of airscrew-driving power plants.

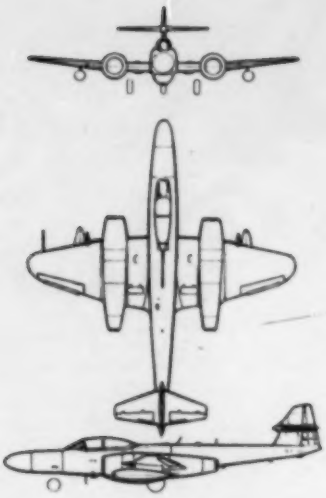
Being a maritime nation we take pride and reassurance that the Fairey Gannet and Short Seamew carrier-borne aircraft are as technically brilliant as they are operationally effective; and as these submarine-killers clear the depths, so will the twin-Avon Supermarine 525 and D.H.110 deck-landing fighters sweep the heights above. We commend to readers also the Hunting Percival Jet Provost trainer—not the fastest jet trainer, and not the smallest; but in its own class, we believe, the best.

No wholly new airliners will be taking the Farnborough air this year, though there is excellent news from the civil market. Best of all is America's ungrudging acclamation and acceptance of the Vickers Viscount—a pleasing and practical vehicle in anybody's language, and one which is carrying our national prestige to new heights on turboprop power. And as the Viscount order book fills, so Bristol's great Britannia—likewise with turboprops—promises no less resounding a success.

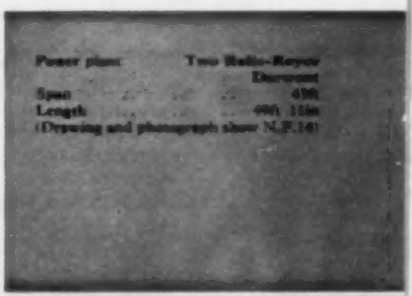
As a nation, our faith still abides in the ultimate triumph of the pure-jet de Havilland Comet, the Series 3 version of which (to be flown at Farnborough) transcends the performance of its smaller, less powerful predecessors.

Among the helicopters at present in being there are no wholly new types, but development of some uncommonly interesting and promising power plants is already under way for some novel designs, varying greatly in size and configuration. Meantime accepted types, notably the Bristol 173 and Westland Sikorsky S.55, are finding increasingly wide acceptance in civil and military fields.

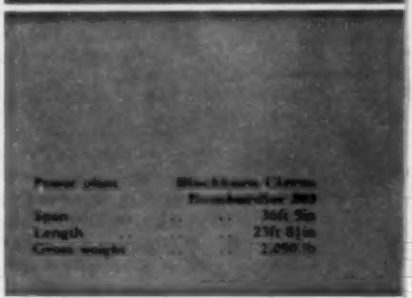
Now, having waved the flag, we bang the drum. The great show is at hand, and through these pages will pass the traditional cavalcade of Britain's aircraft.

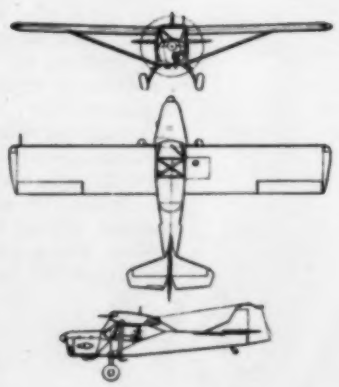


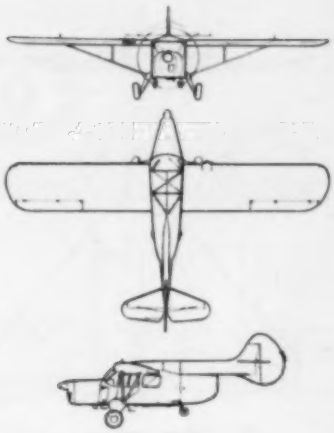
ARMSTRONG WHITWORTH NIGHT FIGHTERS The steps by which Sir W. G. Armstrong Whitworth Aircraft, Ltd., developed a modern two-seater, radar-equipped night fighter from the basic Gloster Meteor design may be summarized as follows: Their first effort—and a remarkably successful one—was the N.F.11 of 1950, which, though having many major parts similar to, or even interchangeable with, those of earlier Meteors, was a new aircraft. The wing was similar to that of the photographic reconnaissance Mk 10, but housed four 20 mm guns outboard of the nacelles; the massive canopy resembled that of the T.7 trainer and the tail was that of the F.8 day intercepter. Although wing-tip auxiliary tanks were fitted on one N.F.11 prototype, these did not become standard, and the earlier types of under-wing tanks were retained for production machines. Chronologically, the next mark was the N.F.13, equipped for operation overseas; and then, in April 1953, followed the N.F.12, having a longer nose of better aerodynamic form and greater capacity and assumed to carry more powerful radar. This mark, too, was the first to embody a fairing for the tail "acorn" to improve airflow and help to balance the added side area of the nose. The N.F.14 dates from late 1953, and is characterized by a new two-piece blown canopy, a sharply raked windscreen and various other differences which it is not permissible to discuss. Officially described as the fastest version of the Meteor yet produced (notwithstanding its heavy service load), it has demonstrated excellent handling qualities and is popular among crews.



AUSTER A.O.P.9 This is Britain's latest offering in the "air observation post" class (in which Auster Aircraft, Ltd., have long been eminent), and was the subject of a very detailed description in *Flight* of June 11th. The essence of the design is to be found in these features: a fuselage 46in wide (considerably broader, that is, than any previous Auster A.O.P.); an excellent undercarriage, embodying Dowty Liquid Springing and Goodyear disc brakes; a "cut-down" rear fuselage and extra-bulbous canopy, giving an exceptional range of view; provision for three seats and for full military radio; a wing of large area, with highly effective flaps and "drooping" ailerons; and a considerably revised structure. The wing has a metal torsion-box leading edge of D-section, and is braced by a single strut; the tail unit is of cantilever stressed-skin type, and the seats and flooring are of honeycomb sandwich material, the floor being so arranged that it can readily be removed and replaced by alternative prefabricated sections fitted with various types of operational gear. The Blackburn Cirrus Bombardier 203 ungeared, unsupercharged direct-injection engine can operate on M.T. fuel; in fact, use of this fuel establishes a precedent, though there are indications that, in actual service, true aviation petrols might be more readily available, giving, of course, a considerable increase in power. A fixed-pitch Fairey-Reed and a Plessey-Coffman starter are standard.





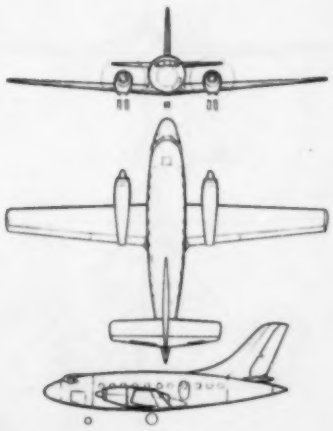


Power plant	Blackburn Cirrus Bombardier 702
Span	37ft
Length	24ft 8in
Gross weight	2,700 lb
Maximum speed	121 m.p.h.

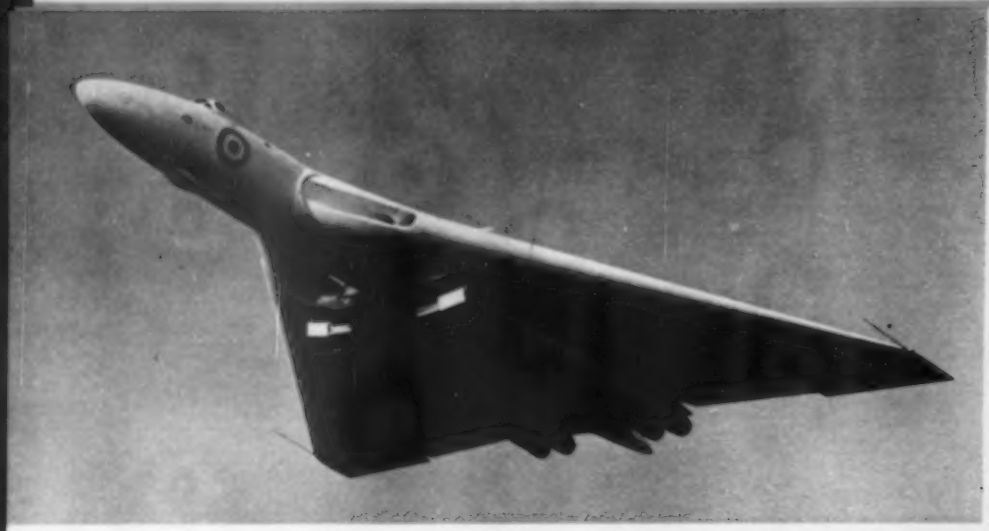
(Drawing shows Ambulance/Freighter; photograph, Aiglet Trainer)

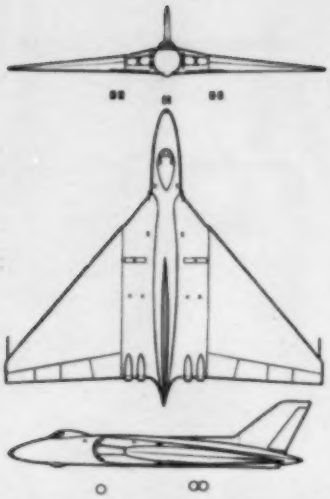
AUSTER AMBULANCE/FREIGHTER, AIGLETS, AUTOCAR The light high-wing monoplanes grouped under the present heading offer exceptional versatility and economy in private, commercial and military service. The Ambulance/Freighter, in fact, is unique, for though it weighs only 2,700 lb all-up, it is a willing worker as a passenger carrier, supply-dropper, cable-layer, survey aircraft and agricultural implement. An especially ingenious feature is the rear-loading facility which, in conjunction with a hold volume of 110 cu ft, admits bulky loads up to 15ft in length; another is the four-wheel undercarriage. A Blackburn Cirrus Bombardier provides power. The ever-popular Aiglet J5F appeared last year in a revised form—with a Gipsy Major 10 engine in place of the former Gipsy Major 1—and recent months have seen Aiglet Trainers supplied to a number of air forces. Although superficially resembling the long series of Auster tourers the Trainer is an extremely lively, fully aerobatic instructional machine, with a high rate of roll, and side-by-side seating for pilot and pupil. Notwithstanding its specialized application, however, the majority of components are interchangeable with those of other Auster types, and a three-seat tourer version can be supplied. The four-seater Autocar, as its name implies, is primarily a tourer, though it is serving also (in the Auster tradition) as a light transport and can be adapted as a trainer. Versions with the Gipsy Major and Cirrus Major have been built in some quantities, and the Cirrus Autocars supplied last year to Australia embodied a special "freight hatch" canopy.

Power plant	Two Rolls-Royce Dart RDa.6
Span	77ft 6in
Length	57ft 6in
Gross weight (initial)	24,000 lb



AVIATION TRADERS ACCOUNTANT A prototype of this 36-seat, pressurized, general-purpose transport aircraft, is under construction and should fly towards the end of next year. It promises to be a machine of unusual technical interest, for with the power of two Rolls-Royce Dart RDa.6 turboprops at their disposal, the makers have sought "to cut away from convention and make a common-sense evaluation of some refinements of design normally taken for granted." They maintain that not only is the cause of reduced first cost served, but weight and complication are reduced—to the benefit of operators of short/medium-range aircraft who are more concerned with dependability in service than optimum performance. This philosophy has led to their dispensing, for example, with expensive undercarriage fairing doors, having complicated linkages and hinges, while the short nosewheel undercarriage units are linked to a common operating jack for retraction and lowering. The Accountant's fuselage is of unique "tensioned-skin" construction, which is claimed to contribute towards reduced cost and weight, improved appearance and structural stiffness, and facilitate major repairs, such as might be sustained from a belly landing. Specifically designed as a replacement for the Dakota, the new transport is intended to reproduce the operating economy and other features of that hardy, willing and frugal servant of the public.



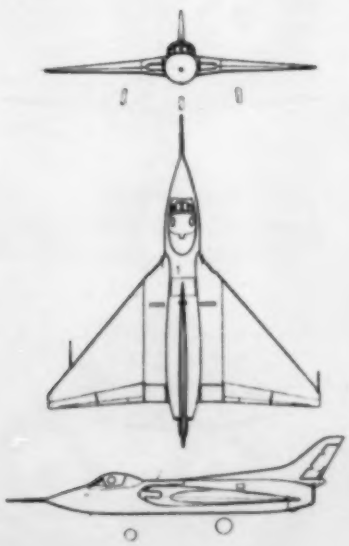


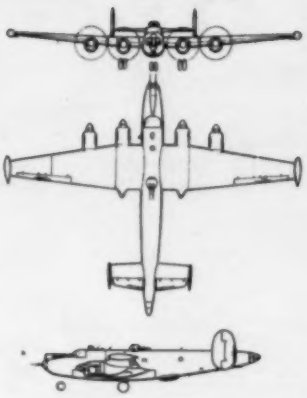
AVRO VULCAN That this delta-wing bomber ascends as a matter of course to heights of 50,000ft and over may be presumed from the knowledge that the Minister of Supply himself was a passenger on a 50,000ft test flight; and some indication of speed and range is afforded by estimated figures for a projected civil version (Atlantic), claimed to be capable of flying non-stop from London to New York in 5-6 hr and of cruising at over 600 m.p.h. at 40,000ft. When the Minister flew in the Vulcan he remarked that all concerned were much encouraged by its splendid performance, and that in test flights it had proved itself capable of more than meeting official requirements in both height and speed. And although visitors to Farnborough last year, and the year before, were left in no doubt as to the Vulcan's tractability at low levels and comparatively low speeds, the Minister is on record as having said that for a large aircraft it is also proving itself "exceedingly manœuvrable" at high altitude and speed. A further statement that the Vulcan "still has quite a lot up its sleeve" can well be believed, for the Bristol Olympus two-spool turbojets, specified as standard, will be delivering progressively greater outputs, and the wing area (a deciding factor in load-carrying ability) must be of the order of 3,000 sq ft. The Vulcan abounds with features of technical interest, among them massive power-operated split control surfaces. Outboard are the ailerons and inboard the elevators. Note, too, the brilliant engineering of the Dowty undercarriage. The Vulcan due to demonstrate at Farnborough is the first prototype, with four Armstrong Siddeley Sapphires.

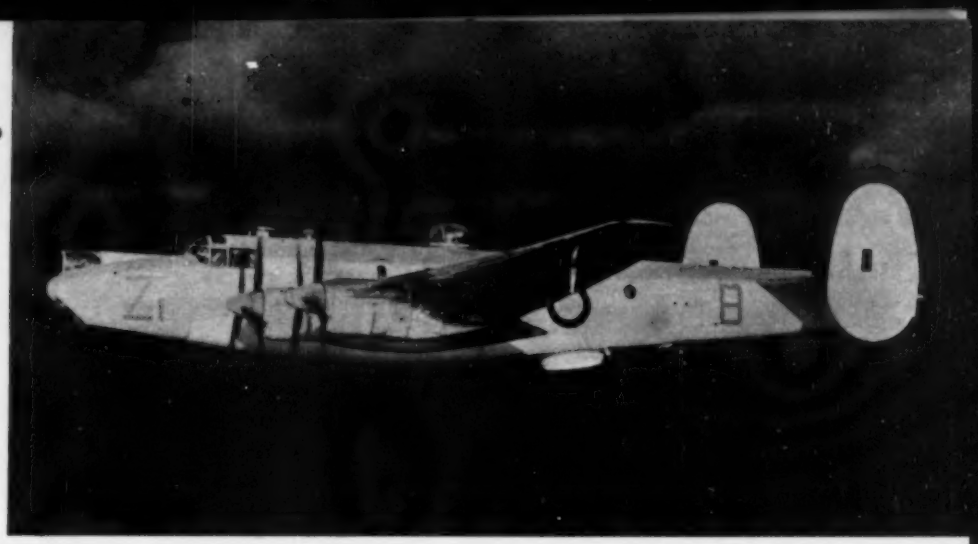
Power plant	Four Bristol Olympus
Span	99ft
Length	97ft 1in

AVRO 707s AND FIGHTER/BOMBER It will be no news to faithful Farnborough-goers that the various Avro 707 delta-wing aircraft have been very closely linked with the Vulcan programme, and not as research vehicles alone, for the 707C, at least, has proved invaluable for familiarization and training. Briefly, we should recall that the original 707 flew in September 1949; the 707B dates from September 1950 and the 707A (intended for higher speed) from July 1951. The 707C was a 1953 innovation and, although essentially similar to the "A," is distinguished by its side-by-side seating and, in consequence, broader cockpit enclosure. In all cases the power plant is a Rolls-Royce Derwent. It would appear that this great little family of deltas may ultimately profit the Avro company not only in the bomber, and possibly transport sphere, but in the highly competitive and extremely exacting fighter/bomber field, for in recent months it has been made known that a delta-wing fighter/bomber, developed from the 707 design, has been planned to meet NATO requirements. The makers are confident that it will be able to land without trouble on a minimum P.S.P. runway with room to spare, and take off in half the minimum required distance. Armament would be heavy mixed loads of rockets, guns and bombs, and speed and range should exceed the specified NATO requirements. The low surface loading and short span afforded by the delta wing should, of course, be beneficial not only in taking off from and landing on small runways, but in manœuvring at high speed near the ground.

Power plant	Rolls-Royce Derwent
Span	34ft 2in
Length	42ft 9in
(Drawing and photograph show 707C)	



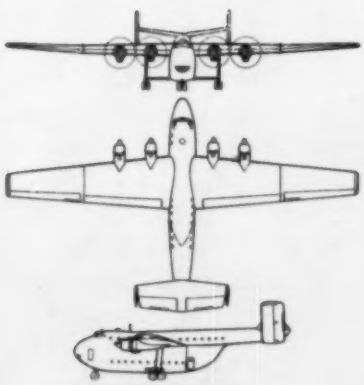




AVRO SHACKLETON A great number of Farnborough visitors in past years have singled out the performance of this massive piston-engined submarine hunter/killer for special mention; and this is hardly to be wondered at, for the Shackleton impresses not only by its appearance (and the awesome roar of its four Rolls-Royce Griffons) but by great reserve of power and ability to manœuvre violently "on the deck." As may be supposed, these qualities would stand it in good stead in a low-level attack on a heavily armed submarine. The latest Shackleton—the M.R.3—will not be ready in time to fly at Farnborough, but it can be said with confidence that this is an even more impressive aircraft than its predecessors. Essentially it resembles the Mk 2, but in place of the tail-down undercarriage it has a nose-wheel gear. Other refinements are a new pattern of cockpit canopy, affording a wider field of view; extensive soundproofing; better furnishing—especially in the new "wardroom" for off-duty crew; and additional fuel tankage, some of which appears to be at the wing-tips. Like the M.R.1 and 2, it will carry a lifeboat as an alternative to a very heavy and bulky complement of offensive stores, which might include bombs, depth charges and homing torpedoes. Shackleton 3s have been ordered not only by the Royal Air Force but by the South African Air Force. The Griffons drive six-blade de Havilland contra-rotating airscrews. A trial installation of Napier Nomad compound engines is being made.

Power plant	Four Rolls-Royce Griffon
Span	120ft
Length	87ft 4in

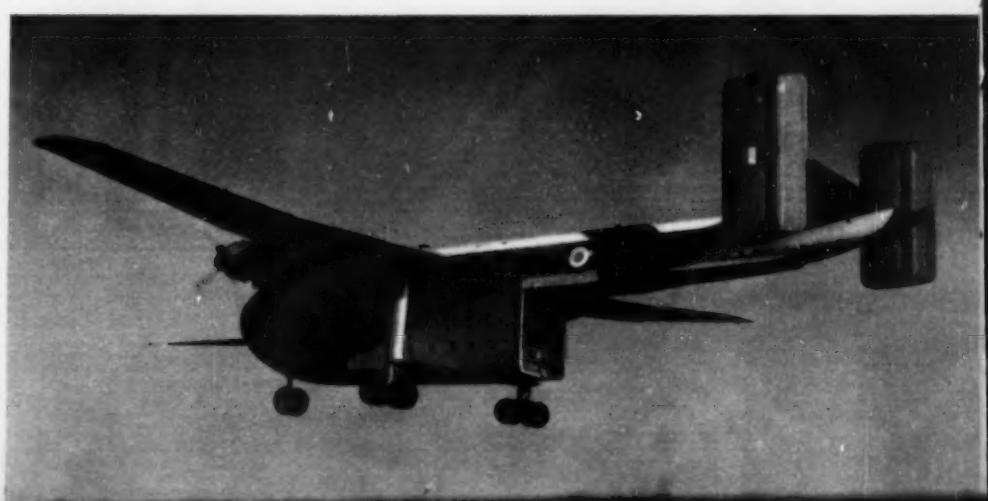
(Drawing shows M.R.3; photograph, and data, M.R.2)

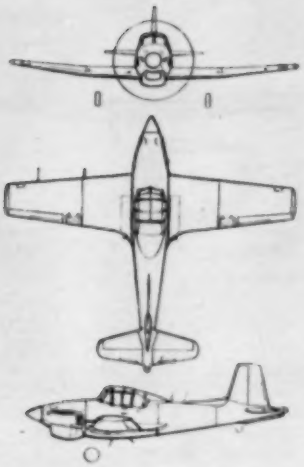


BLACKBURN BEVERLEY AND UNIVERSAL The names Beverley and Universal are explained as follows: the Beverley is a military freighter, powered with Bristol Centaurus engines, now in quantity production for the Royal Air Force, and the Universal is a projected civil variant of similar characteristics, but offered with a variety of power plants. The makers emphasize that the two machines are basically identical and conversion from one type and rôle to the other can be rapidly effected. A detailed description of the Beverley is not yet permissible, but of the Universal it can be said that it would weigh about 61 tons and have a main cargo hold measuring 40ft × 10ft × 10ft. Ten jeeps can be carried in the main freight compartment in addition to troops or passengers in the rear fuselage. From the military point of view it is of the greatest importance to note that the Beverley is the first British aircraft designed for the dropping of heavy army equipment—this by virtue of the removable rear-loading doors. The fixed undercarriage, with its bogie wheels, allows operation without the use of prepared runways, and by the use of wheel brakes, and in a light wind, the Beverley is known to have been using less than half the maker's 1,400-yd runway for landing. This distance could be considerably reduced by the use of braking airscrews, as has already been demonstrated at the S.B.A.C. Display. Attractive operational possibilities for the Universal are evident in Australia, and the type is being considered by the authorities as a vehicle for solving future transport problems.

Power plant	Four Bristol Centaurus
Span	162ft
Length	99ft 2in
Maximum speed	223 m.p.h.
Gross weight	61 tons approx.

(Drawing and photograph show Beverley; data, Universal)





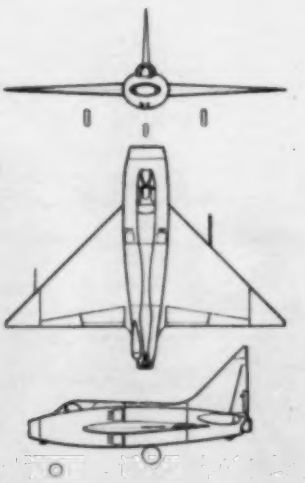
BOULTON PAUL BALLIOL AND SEA BALLIOL These piston-engined advanced trainers differ in the following respects: The Sea Balliol has a special undercarriage capable of absorbing a vertical velocity of 14ft/sec and possessing excellent damping characteristics which enable "quite heavy landings" to be made safely and without rebound. The main undercarriage units, although larger on the Sea Balliol, are similar in working principle to those of the Balliol, the longer stroke and greater displacement providing the extra shock-absorbing capacity required for deck landing. The tail undercarriage unit incorporates a double-extension oleo-pneumatic shock absorber, a separate self-centring unit, a shimmy damper and a steering mechanism controlled from the cockpit. The hydraulically damped arrester hook is also manually controlled by the pilot, and a cable-deflector assembly prevents the arresting cables from fouling the tailwheel. The weight of the arrester hook and stiffened tail cone on the naval variant is offset by moving the accumulators forward to positions in the inner wings, thus avoiding any disturbance of the centre of gravity. A naval requirement for deck landing is an external air-speed indicator and there is a signal discharger, electrically operated from the cockpit, in the port inner wing. The layout of the cockpit is altered in certain respects to meet naval requirements. Both the Balliol and Sea Balliol are powered with the Rolls-Royce Merlin 35 and have achieved a very high reputation for their fine handling qualities and manœuvrability.

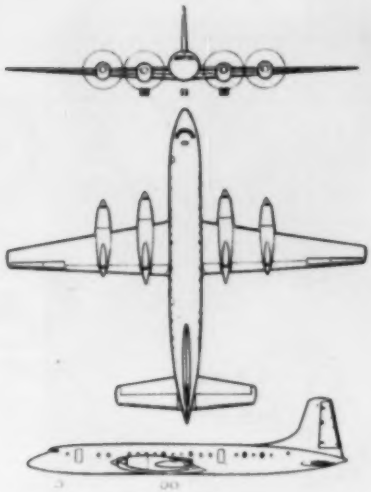
Power plant	Rolls-Royce Merlin 35
Span	39ft 4in
Length	35ft 11in
Maximum speed	288 m.p.h.
Gross weight	8,410 lb

(Drawing shows Sea Balliol; photograph and data, Balliol)

BOULTON PAUL P.111A This high-speed delta-wing single-seater is a development of the P.111 of 1952, and has been built for aerodynamic research "at or near the speed of sound." The main external difference is the provision of four rectangular air brakes, spaced at equal intervals around the fuselage and thus presenting, when extended, and when seen in head-on view, a singular—even fantastic—appearance. A long boom projects from the nose to carry a pressure head, and there are various internal improvements suggested by experience with the earlier machine. The P.111A itself has completed a great deal of flying. Like its predecessor, it is powered by a single Rolls-Royce Nene, the intake of which is of flat, ovoid form. Another characteristic feature is the very wide undercarriage track which, at 14½ft, is about half the span. A parachute housed in a fairing on the port side of the fuselage reduces landing speed and landing run. The machine was designed to fly with wings of different plan forms, one having considerably blunter tips (and consequently being a shorter span) than the other. Although no official announcement has been forthcoming on the point, it is commonly believed that the P.111A is capable of diving at supersonic speed. Its extremely high rate of roll has already been demonstrated at the S.B.A.C. Display.

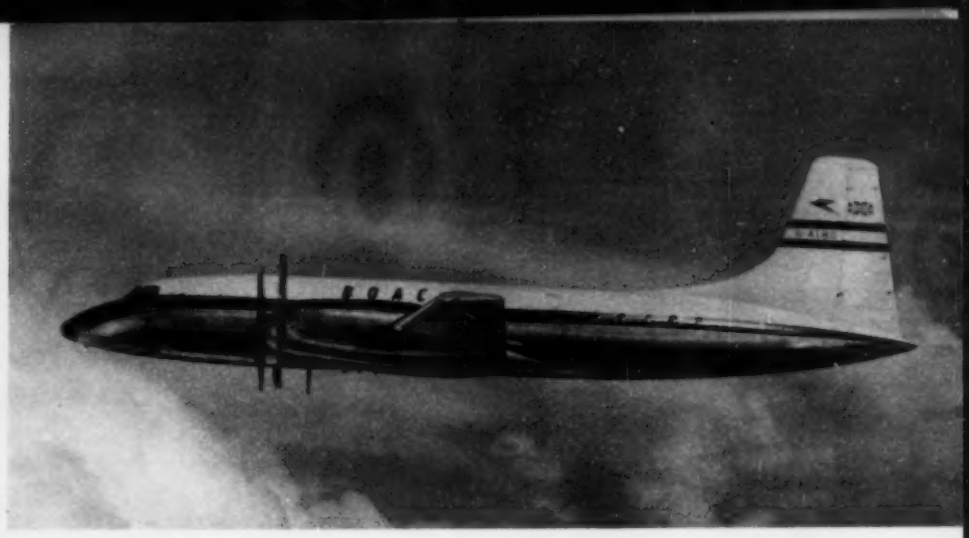
Power plant	Rolls-Royce Nene
Span	33ft 0in
Length	36ft 1in



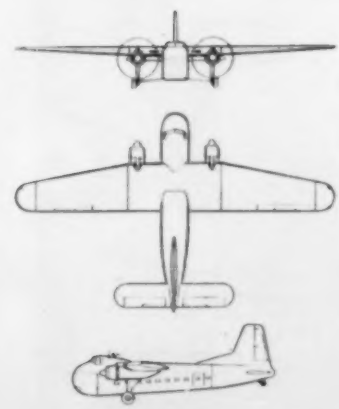


Power plant ..	Four Proteus 785
Span	142ft 3½in
Length	124ft 3in
Gross weight	155,000 lb

(Drawing shows Mk 300; photograph, Mk 100 prototype)



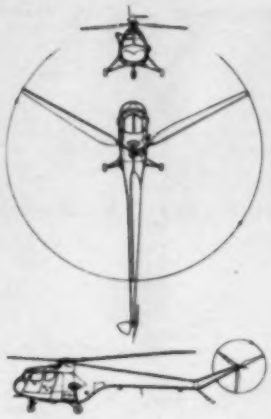
BRISTOL BRITANNIA The Britannias in production for B.O.A.C. will be the first long-range airliners to employ turboprop power. The Corporation has placed firm and tentative orders for a total of 35, and Australia's international airline, Qantas, intends to operate six. The Qantas machines will be Mk 250s—mixed passenger/freight versions, capable of carrying up to 87 passengers and some eight tons of freight. Fifteen of B.O.A.C.'s Britannias will be Mk 100s, with 114ft fuselages and Proteus 705 turboprops. Subsequent aircraft, including the Mk 300s which make up the remainder of B.O.A.C.'s order, will have a 10ft 3in fuselage extension and Proteus 755s. Over 300 hr of Britannia flight time have been logged to date, and Proteus engine hours amount to 3,300 in the air, 23,000 on the test-bed. Flight trials now in progress are aimed at achieving a Certificate of Airworthiness in the near future, and, after proving trials, the Britannia should make its keenly awaited début next year on the world-wide B.O.A.C. route system. Up to 101 seats can be mounted—six abreast for tourist travel—in the long, unrestricted fuselage of the Britannia 300. Beneath the floor are freight compartments of 829 cu ft total capacity. Maximum payload is 30,000 lb, and this can be carried a still-air distance of 3,350 nautical miles. The long-range (L.R.) version, with additional wing tanks to raise fuel capacity from 6,800 to 8,300 gallons, can cover a further 530 n.m. with full payload. Both the "250" and "300" will be available in L.R. form. A heavily armed maritime reconnaissance version is to be built by Canadair for the Royal Canadian Air Force.



Power plant ..	Two Hercules 734
Span	108ft
Length	68ft 4in
Max. speed	225 m.p.h.
Gross weight	44,000 lb

(Data and drawing are for Mks 31 and 31E; photograph shows Mk 32)

BRISTOL TYPE 170 Though the Type 170 has been a familiar sight on short-haul freight routes for many years, it continues in demand by virtue of its capacity, economy and simplicity. Considerably over a hundred of these machines have been delivered in various versions, and operators of the Mk 31 alone (this version carries nearly six tons of freight) include Trans-Canada Air Lines, Aer Lingus, Air Charter, and Straits Air Freight Express, Ltd. Broad, deep, nose-opening doors give access, on the Mk 31, to a cargo hold of 2,020 cu ft capacity, beyond which is a lobby space of 340 cu ft. Height is sufficient to accept a loaded three-ton lorry—or there is room for three jeeps; a Bofors gun with one jeep; or four engines of Hercules or Merlin size. The Mk 31E is a passenger or mixed-traffic machine, with appropriate soundproofing, heating and ventilation, and—in a typical layout—provision for forty-four seats. A more specialized development is the Mk 32, the fuselage of which is lengthened forward of the wings. Developed for Silver City Airways, this Superfreighter, as it is called, carries varying combinations of vehicles and passengers, the hold capacity being variable by means of a wooden partition. When 20 passengers are carried, this partition is placed forward of the structural bulkhead, separating the main hold from what is normally the lobby; but when 12 or fewer seats are demanded it is moved back, increasing the hold length from 37ft 6in to 42ft 3in, and allowing three cars of 14ft length, or two of the largest American makes, to be stowed.



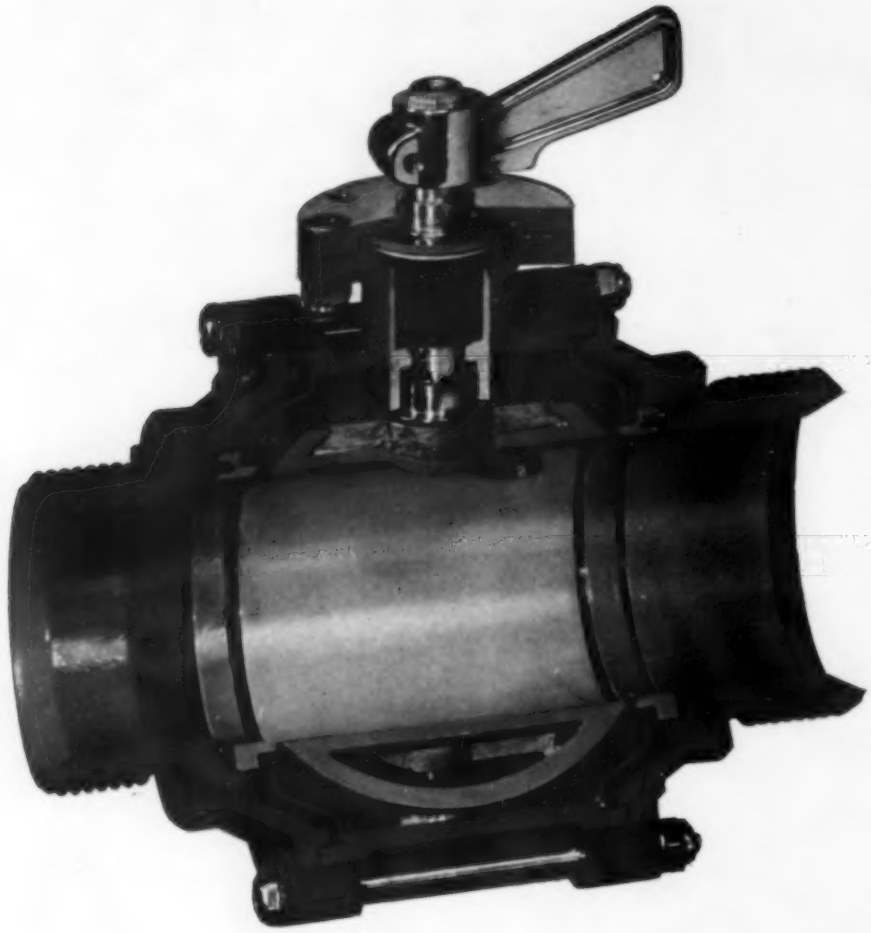
BRISTOL TYPE 171 For numerous civil and military operators the Type 171 helicopter, known in the British Armed Services as the Sycamore, has been supplied in a variety of versions. The current production model—the Mk 4—is suitable for use as a passenger or communications machine, ambulance, search-and-rescue aircraft, aerial crane, or crop sprayer. In the ambulance role the passenger's seat beside the pilot faces aft, for the use of the medical attendant; or, if required, a swivel seat can be fitted. Bars, having quick-release clamps, allow two special folding stretchers to be secured in place, and blood-transfusion equipment is provided. For ordinary passenger and communication work there is the seat alongside the pilot and an upholstered bench-type seat along the rear bulkhead. Soundproofing is quickly installed. In search-and-rescue guise an hydraulic pump is attached to the drive on the main gear-box, and an hydraulic winch is fitted on the starboard side. Three deckchair seats are attached to the rear bulkhead, and the starboard rear entry is closed by a canvas screen and the port entry by a side panel or blister. As an aerial crane the Mk 4 is fitted with a beam attached to strongpoints close to the c.g. and having a quick-release hook; electric and manual quick-release cables are led to a position near the pilot. For crop spraying a tank is attached on each side of the fuselage, and from there the spray booms are fed. With the exception of the rotor blades, the Type 171 is of metal construction throughout and is fitted as standard with the Alvis Leonides engine.

Power plant	Alvis Leonides
Rotor diam.	48ft 6.7in
Fuselage length	42ft
Max. speed	120 m.p.h.
Gross weight	5,000 lb

BRISTOL TYPE 173 The potentialities of this highly promising twin-engined, twin-rotor helicopter are implicit in the official announcement, made in May this year, of a Ministry of Supply production order for "about a hundred of a military version." At the same time it was disclosed that "a larger type, with gas turbine engines, and capable of carrying 27 passengers" was being planned. While, at the time of writing, further particulars of these developments are withheld, the known marks of 173 can be defined as follows: Mk 1, the first prototype, with provision for 10/13 passengers and powered with two Alvis Leonides Mk 73 engines; Mk 2, the second prototype, essentially similar to the Mk 1, but modified to explore the characteristics and effects of stub wings; Mk 3, a winged, 16-seater development, with Alvis Leonides Major engines. The following notes apply to the Mk 3, three examples of which are being built for experimental service with B.E.A. The main portion of the fuselage is of ovoid section and of conventional light-alloy semi-monocoque construction. Twelve of the 16 passengers have individual seats, and the other four share a bench-type seat. In the place of two of these bench-seated passengers a toilet can be installed. Provision is made for a stewardess. As a freighter the Type 173 Mk 3 will carry 3,000 lb as a distributed load, or 2,200 lb as a concentrated load—in which connection it may be noted that the four-wheel undercarriage ensures a level platform, and that the low floor-level and large door (5ft high × 3ft 7in wide) greatly facilitate loading.

Power plant	Two Alvis Leonides
Rotor diam.	48ft 6.7in
Fuselage length	54ft 1.7in
Max. speed	153 m.p.h.
Gross weight	13,496 lb
(Drawing and photograph show Mk 3)	

AT249



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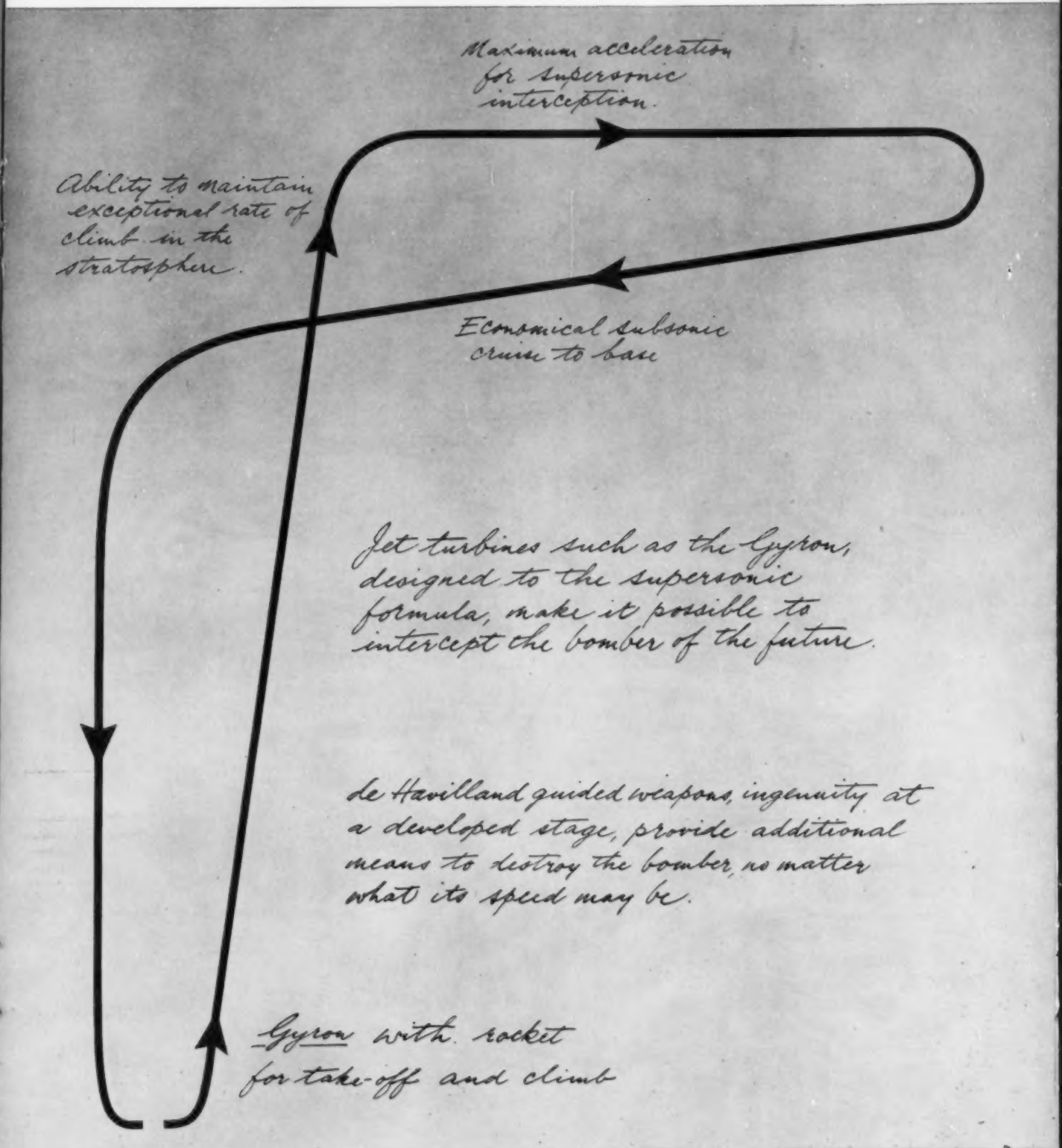
DE HAVILLAND
in the forefront of development

Flight, 3 September 1954


Maximum acceleration for supersonic interception.
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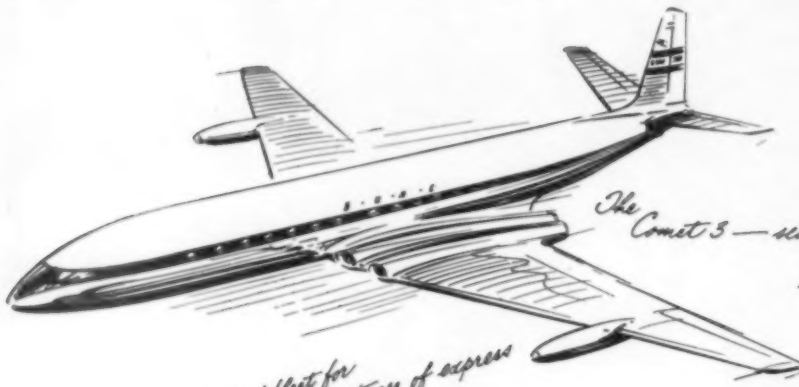
Economical subsonic cruise to base
Jet turbines such as the Gyron, designed to the supersonic formula, make it possible to intercept the bomber of the future.
de Havilland guided weapons, ingenuity at a developed stage, provide additional means to destroy the bomber, no matter what its speed may be.
Gyron with rocket for take-off and climb

de Havilland rocket engines, air-breathing turbines and guided weapons for the defence formulæ of the future

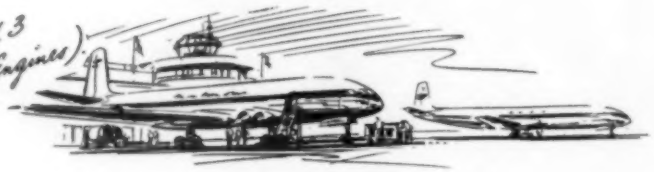
DE HAVILLAND traditionally



The Comet 3 — seats 58 first-class passengers, or up to 76 tourist-class passengers — but Comet speed and smoothness will always attract first-class fare.

The logical paired fleet for the medium and the long stages of express world traffic.

Comet 2 and 3 (Rolls-Royce Avon Engines).



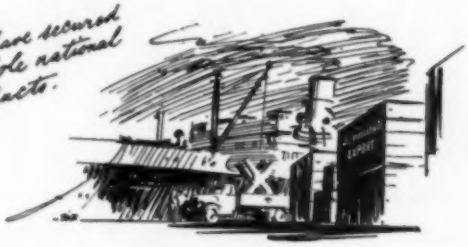
The Beaver, Canadian-bred utility vehicle, rugged and simple, approaches the helicopter in capability — with a half-ton payload.

The Canadian Otter handles the still larger and more cumbersome loads of military and civil utility transport —

It is proving itself in all manner of military and civil functions

14 passengers or a ton of freight.

The de Havilland Companies have secured a large share of the whole national export of aircraft products.

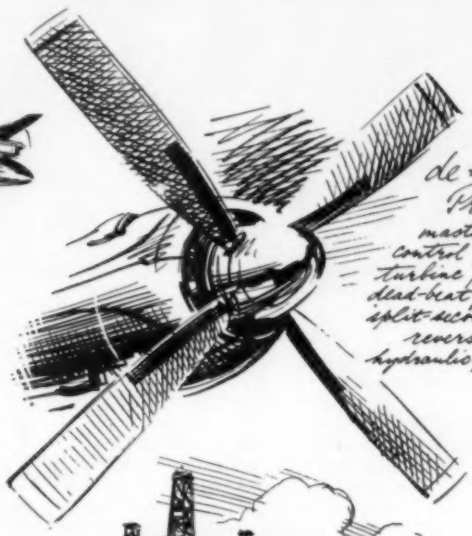


de Havilland transports, industrial and

serving world trade and industry

Retractable or fixed undercarriage for the Heron. the relative economy depends mainly upon stage length.

Gipsy Queen 30 engines and propellers by de Havilland.



de Havilland Propellers master the control problems of turbine power — dead-beat governing, split-second feathering, reversing, hydraulic pitch-locking.

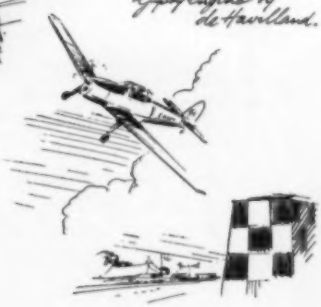
The Heron offers four-engine safety in executive travel, with quite unapproached economy.

The Dove continues to be regarded as the ideal small executive aircraft, economical, elegant, efficient. (Gipsy Queen 70 engines and propellers by de Havilland)

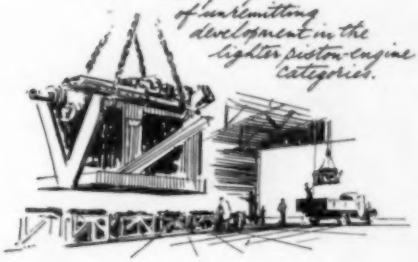
The Heron 14- to 17-passenger branch-liner, because it offers high frequency with unprecedented economy and safety, is becoming a world favourite for airline operations.

Seats of the executive Dove are convertible into couches.

The Chipmunk, born in Canada, is the world's best club trainer. Gipsy Engine by de Havilland.



Gipsy Engines: nearly 30 years of unremitting development in the lighter piston-engine categories.



The de Havilland World-wide Service Organisation — a most extensive and diverse responsibility to military and civil operators.

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Flight,
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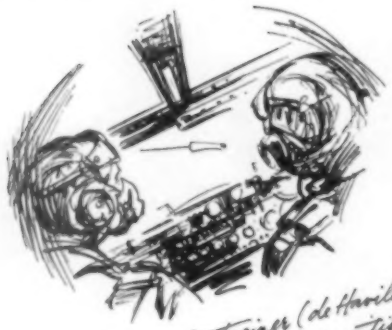


The Vampire trainer (de Havilland Goblin engine) — has world-wide recognition for safe and economical initiation into the techniques of jet flying and combat. — It is also an operational aircraft.

The Chipmunk — is the best and most economical elementary trainer.

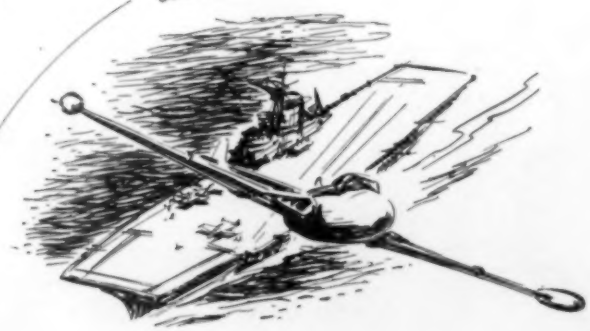
The Venom F.B.4 (de Havilland Ghost engine) — Carries important responsibilities in two roles — ground attack and interception at altitude.

The de Havilland 110 — all-weather full-radar fighter affords a carrier-borne capability hitherto unheard of.

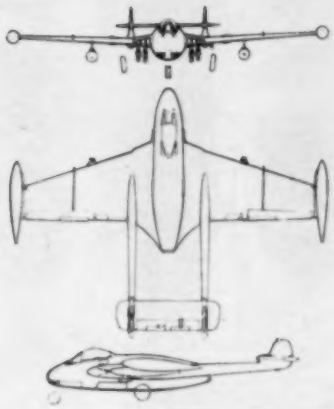
The Devon — really economical for flying client-room duty and communications.

The Sea Venom 21 (de Havilland Ghost engine) — the new two-seat radar all-weather fighter and strike aircraft of the Royal Navy and the Royal Australian Navy.

The Venom N.F.3 (de Havilland Ghost engine) - a two-seat, radar interceptor carries responsibility for Britain's night defence. The Venoms excel in climb and manoeuvrability, especially at altitude.



de Havilland naval and military fighters and trainers
for co-ordinated international protection

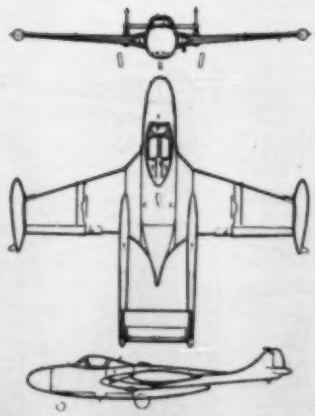


Power plant	de Havilland Ghost
Span	41ft 9in
Length	33ft

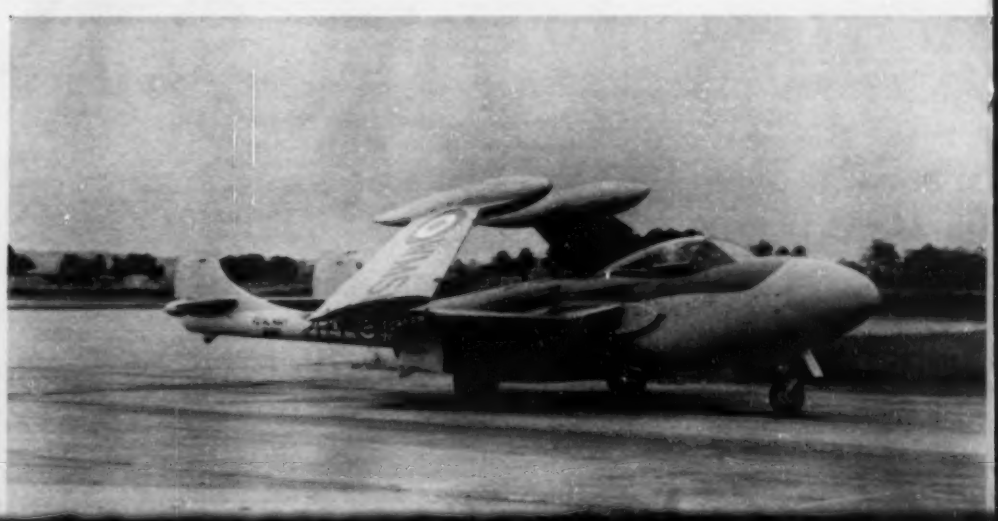
(Data and drawing are for F.B. 4; photograph shows N.F. 3)

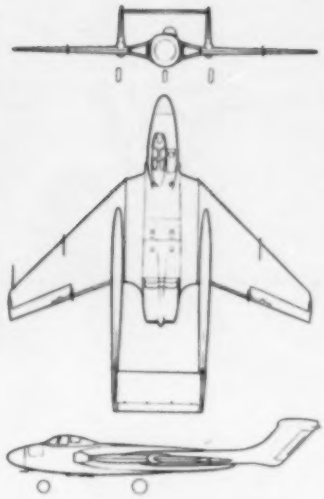
DE HAVILLAND VENOM The land-based Venom, which has a naval counterpart in the Sea Venom, described below, is produced in two basic forms—a single-seater fighter/bomber and a two-seater night fighter. Single-seat variants are the F.B. 1 and a new development of that type, the F.B. 4, concerning which little can at present be said except that it has "greater powers of control near the upper limits of its performance," and that it is following the F.B. 1 on the production lines for the R.A.F. and overseas air forces. Built-in armament—as on all Venoms—is four 20 mm British Hispano guns, and there is provision for two 1,000 lb or 500 lb bombs or for a variety of bombs of smaller calibres, clusters of anti-personnel bombs, rocket projectiles and napalm tanks. The Venom night fighters are the N.F. 2 and N.F. 3, both of which have been supplied to the R.A.F. Although actual figures are withheld, it is permissible to say that the N.F. 3 incorporates improved controls and attains a higher Mach number than its predecessor. Certainly there is little reason to doubt the maker's claim that the high-altitude performance and manœuvrability of all Venom fighters is still unapproached by any other two-seat radar-equipped fighter in service, for, notwithstanding the elaborate equipment now demanded, wing-loading and power loading remain moderate. All Venoms are powered with the D.H. Ghost turbojet, and all are fully aerobatic with auxiliary fuel tanks in place at the wing-tips.

Power plant	de Havilland Ghost
Span	41ft 9in
Length	35ft 3in



DE HAVILLAND SEA VENOM Two marks of the Sea Venom carrier-borne fighter—the N.F. 20 and 21—have been supplied in quantity to the Royal Navy, and a similar machine, known as the Aquilon, is built in France by Société Nationale de Constructions Aéronautiques du Sud-Est for the French Navy. The N.F. 21, which is the current production version in Great Britain, is a "navalized" counterpart of the land-based N.F. 3, in common with which it has a new, more powerful, control system, resulting in improved manœuvrability at high Mach numbers. It is equipped with power-folding wings, catapult gear, provision for rocket-assisted take-off and an arrester hook, stowed in a prominent fairing on the rear end of the central nacelle. Built-in armament is four 20 mm guns. As in the land-based Venom night-fighters, the crew sit side by side, but with the observer (who wears a back-type parachute) slightly behind, and to the right of, the pilot. Both pilot's and observer's positions are fitted for pressure breathing and g-suit. On a recent visit to a Fleet Air Arm squadron equipped with Sea Venoms *Flight* was assured that the aircraft is comfortable to fly in and that its performance, especially at height, is up to Venom standard. Under-wing provision is made for eight rocket projectiles so that, with its radar, the Sea Venom is capable of anti-shipping strikes by day or night.



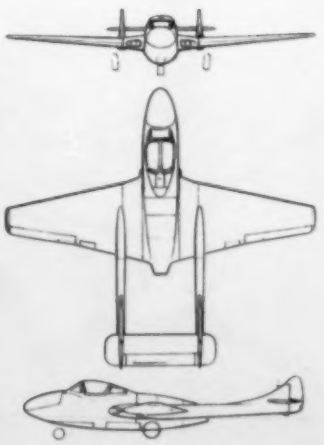


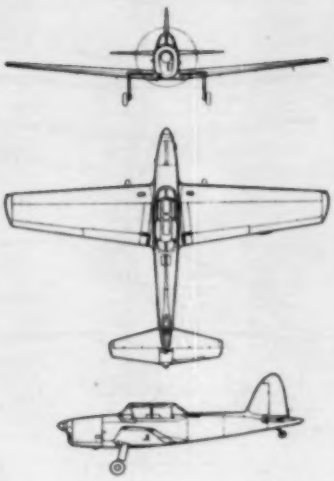
DE HAVILLAND D.H.110 Originally designed for shore-based service, this two-seat, twin-jet all-weather fighter is now under development as a replacement for the carrier-borne Sea Venom. The essential features of the design—as unique as it is bold—are now well known, but it may be recalled that the pilot's cockpit enclosure is offset to the port side of the central nacelle, or fuselage, to the rear of which the twin Rolls-Royce Avon turbojets are installed side by side. These are fed from wing-root intakes in the traditional de Havilland manner and—again following established D.H. practice—the tail is carried on twin booms. In April this year the 110 began flight trials with an all-moving tail-plane, and was the first British fighter to be so equipped. During the second flight with the new tail the speed of sound was exceeded in a dive—an accomplishment for which the aircraft had already become famous, with the original form of empennage. (It was, in fact, the first two-seater fighter in the world to exceed the speed of sound—in April 1952.) Farnborough visitors may also note that the keel surfaces beneath the fins and rudders have been revised in outline since the aircraft was demonstrated last year, and that the leading edges of the mainplanes, outboard of the "fences," have been extended forward. The mark of Avon at present installed may not be specified, but it can be said that the airframe is designed to make use of greater powers as output develops.

Power plant	**Two Rolls-Royce Avon**
Span	51ft
Length	52ft

DE HAVILLAND VAMPIRE TRAINER The single-seat Vampire was originally designed as an intercepter, and in that role achieved in its day an unsurpassed reputation for behaviour at high altitudes. Then, as a fighter/bomber it showed that it was an equally good proposition at low levels, even when carrying heavy service loads. Next it appeared as a night fighter, with side-by-side seating and modern radar aids; and from that ingeniously contrived variant was evolved the Vampire Trainer, which now promises to surpass the reputations of all its predecessors. Instruction in fighter-navigation, combat, bombing, gunnery, rocket firing, the effects of compressibility and low flying are the principal duties listed by the makers; and having regard to this versatility, and the economy afforded by a standardized basic airframe and the Goblin turbojet, it is not surprising that orders have been received from no fewer than thirteen overseas air forces, in addition to the Royal Air Force and the Royal Navy. In the R.A.F. the Vampire is now the standard advanced trainer, to which pilots will graduate from the piston-engined Hunting Percival Provost. The same armament can be carried as on the single-seat Vampire, though normally only two of the four 20 mm guns are mounted for training. Possible under-wing loads are eight 25 lb rocket projectiles, and two bombs of 500 lb or 1,000 lb; or eight light practice bombs in place of the 100-gal external pylon-mounted fuel tanks.

Power plant	**de Havilland Goblin**
Span	38ft
Length	34ft 6in
Max. speed	538 m.p.h.
Gross weight	11,600 lb





Power plant	de Havilland Gipsy Major
Span	34ft 4in
Length	25ft 5in
Max. speed	138 m.p.h.
Gross weight	2,100 lb

DE HAVILLAND CHIPMUNK As pretty as it is practical, the Chipmunk is now used for civil or military flying instruction in twenty countries. Though designed by de Havilland Aircraft of Canada, Ltd., it passed into full production in Great Britain, where it is now offered in two forms—Mk 20 (military) and Mk 21 (civil). The version serving with the R.A.F. is designated Chipmunk T.10 and, like the Mk 20, this is powered by the Gipsy Major 8 engine, whereas the Mk 21 has the Gipsy Major 10 Mk 2. In no aspect of its lively performance is the Chipmunk more outstanding than in its aerobatic ability. Thus, all standard manoeuvres, such as stall turns, slow rolls, half rolls, hesitation rolls, loops, and rolls off the top of loops are performed smoothly and effortlessly. Rolls are possible at the recommended cruising speed in level flight, and loops require an increase of only 8 or 9 knots. Flown solo, the Chipmunk will gain 500ft in a "roll-off." The structure is all metal, and the enclosure over the tandem cockpits is reinforced for the protection of the pilot and pupil in the event of the machine overturning. By reason of the wide-track undercarriage, there is little tendency to swing on take-off, even when throttle is opened too quickly. Controls for the single-disc differential brakes are duplicated in both cockpits, and sliding amber screens, for use with blue goggles, are provided for blind-flying training.

Power plant	Four Rolls-Royce Avon 503
Span	115ft
Length	96ft
Typical cruising speed	500 m.p.h.
Gross weight	120,000 lb

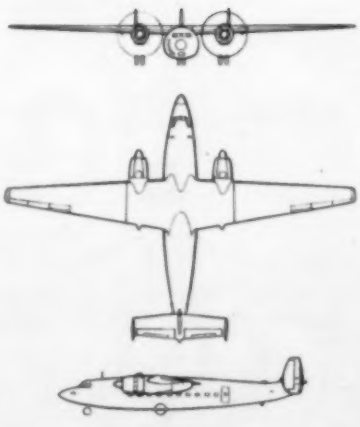
DE HAVILLAND COMET 2 The de Havilland company looks forward eagerly to the opportunities which the S.B.A.C. Exhibition will afford for discussion of the Comet outlook as a whole. Meanwhile, it reports rapid and heartening progress in the investigation of the accidents to the Comet 1, and confidently expects that the new Comet versions for medium and long stages—the Comet 2 and 3—will both be flying in the display. "Besides being the first, and still the only, jet airliner in the world at a time when the changeover to jet propulsion for first-class travel is called for," a recent statement runs, "the Comet now bids fair to be by far the most exhaustively tested airliner in existence. Out of the troubles good is emerging. Comets have now been flying more than five years, and two major steps of development have been made with these aircraft. . . The value of the accrued experience, unique to the Comet, is enormous, and there is no short cut to this kind of knowledge." Whereas the Comet I and 1A were built to carry 36-40 passengers and weighed, respectively, 107,000 lb and 115,000 lb, the Comet 2 will take 44 first-class passengers in its longer fuselage, and weighs 120,000 lb. Its power plant is four Rolls-Royce Avon 503 turbojets, which allow stage lengths of 1,750-2,200 miles. Capacity payload is 13,000 lb. More than 30 Comet 2s have been ordered—by B.O.A.C., Canadian Pacific Airlines, Linea Aeropostal Venezolana, Panair do Brasil, Japan Air Lines, U.A.T. and Air France.

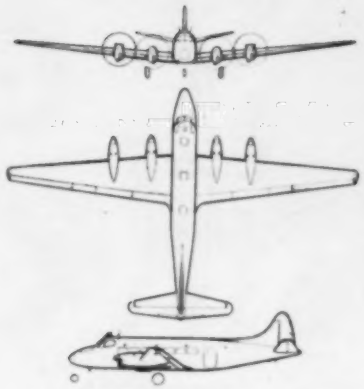
DE HAVILLAND COMET 3 In all respects the most impressive of the Comets, the Series 3 flew for the first time on July 19th; and of the features which distinguish it from its predecessors, the most noticeable is the much lengthened fuselage—15ft longer than that of the Comet 2. Though wing area has been increased, the span remains unchanged at 115ft; the tailplane area has also been increased and cabin windows are now circular instead of square. The power units are Rolls-Royce Avon 521s, and fuel capacity has been increased from 6,900 gallons in the Comet 2 to 8,050 gallons, by the addition of "pinion" tanks mounted forward of the leading edge of the wing. These tanks, incidentally, also contain landing lights. The new "drooped" leading edge—adopted for the Comet 2 at a late stage of production—is incorporated as standard, and flap area has been much increased. In addition to the wing flaps, moreover, there is now a large split flap beneath the fuselage. Although B.O.A.C. and Pan American Airways intend to operate first-class versions of the Comet 3, it is emphasized that the aircraft is fully adaptable for tourist work, with up to 76 seats. A 71-seat version, for instance, with five-abreast seating pitched at 40in, and a 14½in gangway, has been suggested. Gangway width would increase to 20in in the 58-seater and 62-seater four-abreast versions. A "mixed travel" scheme has also been mooted, with the kitchen mounted centrally.

Power plant	Four Rolls-Royce Avon 521
Span	115ft
Length	111ft 6in
Gross weight	145,000 lb

DE HAVILLAND/AIRSPEED AMBASSADOR Under the British European Airways class-name Elizabethan, this twin-engined, high-wing transport aircraft has established for itself a reputation for "passenger appeal" unsurpassed in its class. This stems in part from the high-wing layout which, in conjunction with the large-area windows, affords an unrivalled field of view from the 47-seat cabin. As for economy, the chief executive of B.E.A. has reported that on the airline's shorter routes (the average international stage is 313 miles) the Elizabethan—of which there are twenty in regular service—is the most economical of the entire Corporation fleet. The engines are Bristol Centaurus 661s, enclosed in specially developed low-drag cowlings and mounted as interchangeable power eggs, and the airscrews are four-blade, fully feathering, reversible-pitch de Havillands. Integral tanks in the outer wings each hold 500 gallons, and there is provision for two additional bag tanks of 300 gallons. The cabin measures 32ft 5in long by 10ft 6in wide by 6ft 4½in high; there are two toilet compartments and a cloakroom at the rear. Baggage and freight compartments are in the nose and hand luggage is stowed on the port side between the crew quarters and main cabin. The galley is to starboard. Structurally, as well as aerodynamically, the Ambassador is a highly refined aircraft, especially in respect of the high-aspect-ratio wing. The fuselage is notable for its characteristic broad cross-section.

Power plant	Two Bristol Centaurus 661
Span	115ft
Length	82ft
Max. speed	300 m.p.h.
Gross weight	92,500 lb



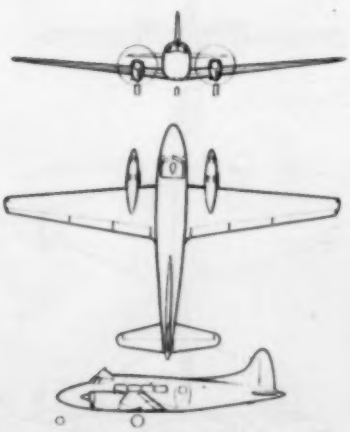


Power plant	Four D.H. Gipsy Queen 30
Span	71ft 6in
Length	48ft 6in
Cruising speed	185 m.p.h.
Gross weight	13,000 lb

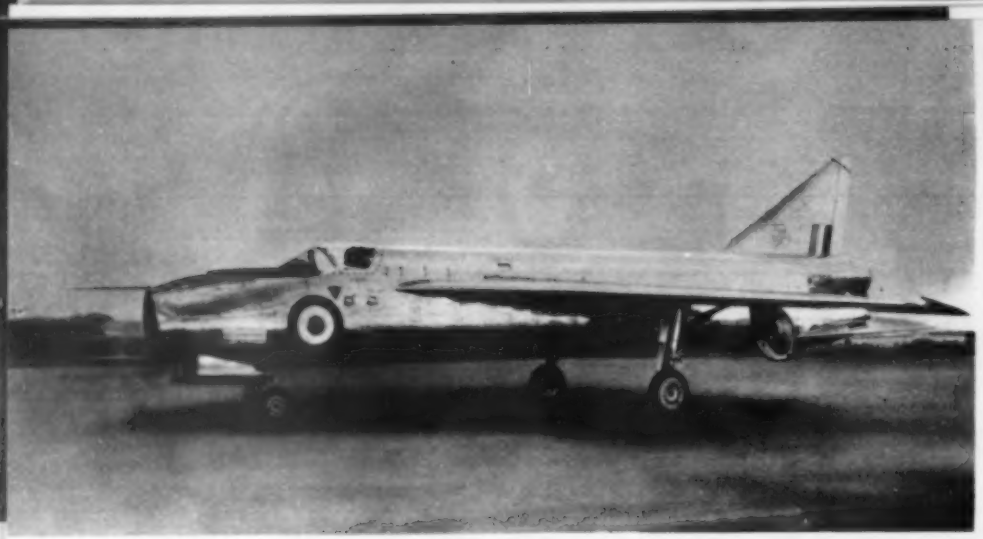
(Drawing and photograph show Series 2)

DE HAVILLAND HERON In the design of this four-engined light transport emphasis was placed upon simplicity; thus, the engines are ungeared and unsupercharged and, in the Series 1, the undercarriage is fixed. With a view to operation in many parts of the world it was ensured that the machine should have exceptionally good take-off and landing qualities, that it should be easily maintained, and use as many parts as possible in common with the smaller, twin-engined Dove. For the longer stages it was decided to offer a version —the Series 2—with a retractable undercarriage, the extra weight of which is more than balanced by the saving in fuel due to the lower drag. Hence, over a stage length of 500 miles, using the S.B.A.C. standard allowances for Instrument Flight Rules conditions, where considerable fuel allowances must be made for diversion, stand-off, etc., the Heron 2 carries the same payload as the Series 1, with a saving of nearly twenty minutes. As a light airliner the Heron is already operating in Australia, Brazil, Canada, French Africa, Jersey, New Zealand, Norway, Uruguay, Indonesia and Saudi Arabia. For commercial service seating is provided for 14-17 passengers, and for executive work eight people are taken in exceptional comfort. The cabin is 19½ft long and the headroom is 5ft 8½in over its entire length. The windows are unusually large and, while the Heron does not pretend to offer all the detailed refinements of the main-liner, it does offer a high degree of individual passenger comfort.

Power plant	Two D.H. Gipsy Queen 70 Mk 2
Span	57ft
Length	39ft 3in
Max. speed	210 m.p.h.
Gross weight	8,500 lb



DE HAVILLAND DOVE Some 450 Dove twin-engined light transport or executive aircraft have now been sold to 35 countries, and in none of these is the type more popular than in the U.S.A. Variants now offered are the Series 5 (8-11 passengers) and Series 6 (four seats, executive model), the performance of which is considerably improved over that of earlier series by the fitting of the Mk 2 development of the Gipsy Queen 70 engine. The Dove looks—and is—quite a fast aircraft, and though the recommended cruising speed is 179 m.p.h. (at 60 per cent m.e.t.o. power at 8,000ft), weak-mixture cruising speeds of up to 202 m.p.h. are readily attainable if required. This performance is due not only to the very clean aerodynamic design, but to the use of geared and supercharged engines, in conjunction with a retractable undercarriage. Full dual control, comprehensive radio and instruments, and metal construction all contribute to the validity of the description "an airliner in miniature." The standard eight-passenger seating arrangement allows for four forward-facing seats on each side of the cabin, which is separated from the pilot's compartment by a bulkhead and door; another bulkhead at the rear separates it from the entrance lobby and toilet. This version can be converted to a nine-seater by having an extra chair in place of the toilet and removing the rear bulkhead. On the shortest runs eleven passengers can be taken by fitting two more seats side by side in the aft luggage compartment.



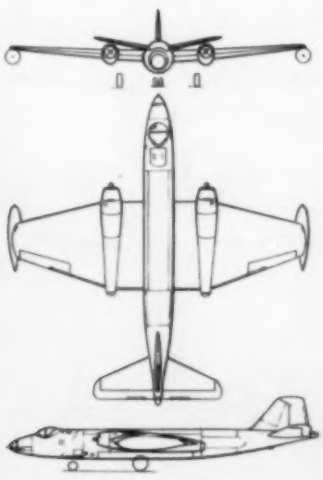
No drawings or data available

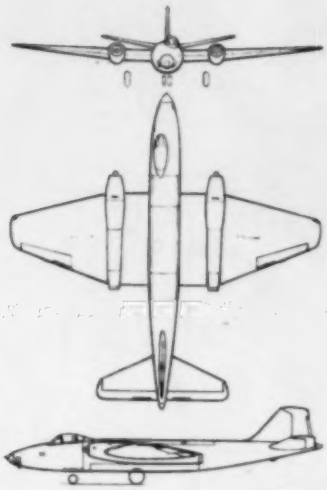
ENGLISH ELECTRIC P.1 The P.1—which first flew on August 4th—is the first British fighter to achieve supersonic speed in level flight and is probably the fastest fighter prototype in the air today. Its great speed is made possible not only by extremely advanced aerodynamic design, with sharply swept-back wings of unusual form, but by its two Armstrong Siddeley Sapphire turbojets, installed in the rear of the very deep fuselage. It has been officially stated by the Minister of Supply that some twenty pre-production P.1s have been ordered for development trials, and it may be supposed that these will differ in certain respects from the first machine. The order, of course, will make it possible to carry out many of the flying and equipment tests concurrently, and should shorten the development period appreciably, although the designer of the P.1 has pointed out that as the full range of flight testing at both transonic and supersonic, as well as at subsonic, speeds will have to be undertaken, the testing period may tend to be even longer than usual in the past. Features of the design were tried out on the Short S.B.5 research aircraft; the curious formation of the leading edge, for instance, and the low-set tailplane, were both featured in one configuration of the Short aircraft. All technical details of the P.1—other than those which are obvious from the photograph—are withheld, but it can be said with certainty that the wing is extremely thin and that the ailerons are horn-balanced. A tail braking-parachute appears to be fitted.

Power plant	Two Armstrong Siddeley Sapphire

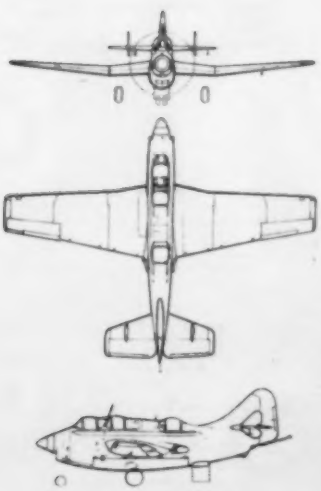
ENGLISH ELECTRIC CANBERRA MKS 1-7 A year ago the Canberra family tree was as follows: B.1 (original two-seat light bomber); B.2 (production type three-seat bomber, built in four factories); P.R.3 (photographic reconnaissance); T.4 (dual-control trainer); B.5 (target marker); and B.20 (Australian-built three-seat bomber). Additionally there was the American B-57 night-intruder development, powered by Armstrong Siddeley Sapphires in place of Rolls-Royce Avons, and several flying test-beds, including the Olympus-Canberra, which achieved the world's altitude record of 63,668ft. It is now permissible to mention three new marks of British-built Canberra, one of which, the Mk 8, differs to such an extent that it is given separate consideration. The B.6 is an improved version of the B.2 with Avons of later mark; and the P.R.7 is a photographic reconnaissance version, with a similar power plant. Canberra bomber squadrons of the R.A.F. are practised in attacking from "deck levels" to heights of over 40,000ft, and the plotted results indicate a satisfactory standard for both visual and blind dropping. Extracts from the report of a member of *Flight's* staff who flew in a Canberra on recent exercises read: "Having levelled out at about 42,000ft we settled down to a period of cruising at around 500 m.p.h. . . . At top altitude the Canberra remains unexpectedly manœuvrable and responsive to controls. . . . . On occasions during descent the air brakes were used, and without clawing the aircraft back they were most effective to preventing excess speed building up. . . ."

Power plant	Two Rolls-Royce Avon
Span	64ft
Length	65ft 6in
(Data, drawing and photograph are for B.6)	





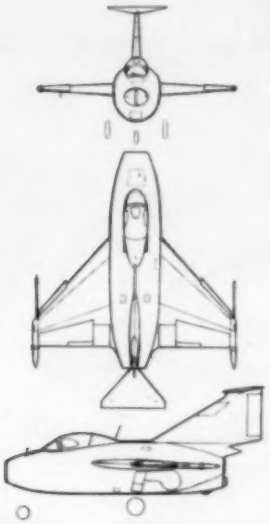
Power plant	Two Rolls-Royce Avon
Span	64ft
Length	65ft 6in



Power plant	A.S. Double Mamba
Span	54ft 4in
Length	43ft

ENGLISH ELECTRIC CANBERRA B.8 This night-intruder development of the Canberra flew for the first time as recently as July 23rd this year and is considered to be the most versatile member of the whole family, being designed to perform in two rôles. First of these is long-range night intrusion—or "interdiction"—over enemy territory, with the object of attacking ground targets, especially communications; the second is the Canberra's normal commitment of high-altitude bombing. Conversion from one rôle to the other is quickly effected. For night intrusion an unspecified forward-firing armament is mounted in a fairing beneath the fuselage, and provision is made for "a variety of weapons" under the wings. (In this last connection it may be noted that the Martin B-57B—an American development for similar duties—carries as a typical under-wing load eight rocket projectiles and four napalm tanks, in addition to the wing-tip auxiliary fuel tanks.) The armament of the Canberra B.8 is, of course, under the control of the pilot, who is seated under a new, fighter-type, canopy offset to the port side of the fuselage, and from which an extensive all-round view is attainable. The second crew-member—the navigator—is in the nose with "a wide range of navigational equipment." The B.8 has the more powerful Rolls-Royce Avons which characterize the B.6 bomber and P.R.7 long-range, high altitude reconnaissance aircraft.

FAIREY GANNET Gannet A.S.1 three-seater carrier-borne anti-submarine aircraft, powered with the Armstrong Siddeley Double Mamba turboprop, are now undergoing intensive service tests in the Fleet Air Arm preparatory to equipping a number of squadrons. Notwithstanding the Gannet's rapidly advancing stage of production, however, technical details are still withheld, though it can be said that the weight of the aircraft is more than twice that of the last-war Swordfish. (In torpedo/bomber condition the Swordfish weighed over 8,000 lb.) It can also be stated that the Gannet is built on the "envelope jigging" principle—in effect, "from the outside inwards." Each wing folds, under power, at two points, and the stowed height is thus kept down to 13.75ft. A very long, broad weapons bay accommodates the latest anti-submarine weapons, and to the rear of this is a retractable "bin" for the search radar. The use of the Double Mamba turboprop means that it is unnecessary for carriers equipped with Gannets to store petrol—a vulnerable commodity—and that the aircraft can protract its endurance by cruising on half power (i.e., with one half of the Double Mamba shut down), reserving full output for take-off, strike and emergency. Three weeks ago the first flight of the Gannet T.2 was announced. This type will provide advanced training for crews in weapon and engine handling, and No. 3 cockpit is adaptable to carry either a radio operator or two passengers.



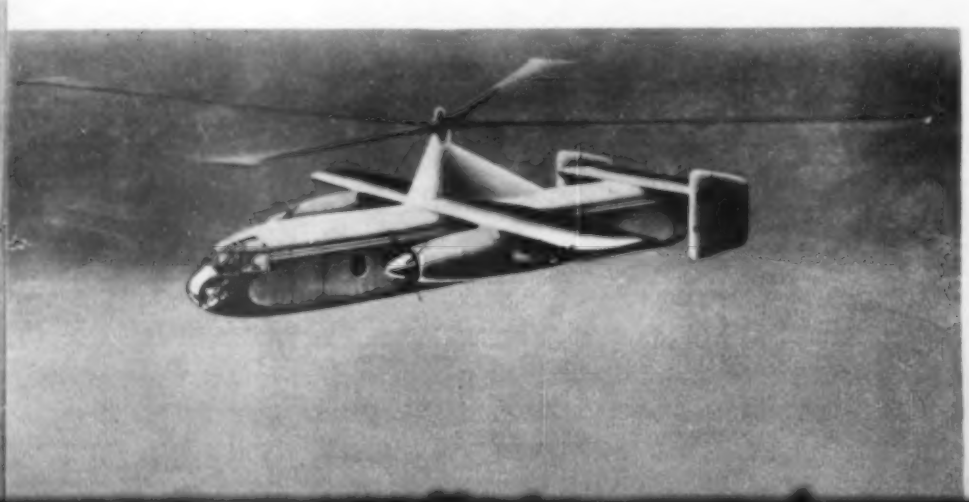
FAIREY F.D.1 AND FIREFLY Although the F.D.1 delta-wing research aircraft made its first flight early in 1951, it has never been flown at a public display, and its appearance at Farnborough this year is a matter of considerable interest, for it is known that the machine was designed "for important research work with revolutionary possibilities in the design and operation of fighter aircraft." It is not without significance that the Fairey V.T.O. (vertical take-off) model, illustrated on a later page, reproduces the basic design of the F.D.1. The power plant is a Rolls-Royce Derwent, but bullet-shaped fairings originally grouped around the tail pipe suggest that rocket propulsion was also envisaged. Also at Farnborough will be a Mk 8 Firefly, powered with a Rolls-Royce Griffon engine. This machine is similar in design to the Firefly 7 but is intended for use as a radio-controlled target-drone. Remote control is effected through the automatic pilot and electric actuators, and an arrester hook is fitted to facilitate radio-controlled landings. Although described as a target-drone, it is obvious that the Firefly 8 can be used for a variety of duties, i.e., flying through atomic clouds, as have American machines of the class. Provision is made for a pilot and an observer, the latter seated in the rear cockpit, facing forward. A photograph appears under the heading "Research and Development."

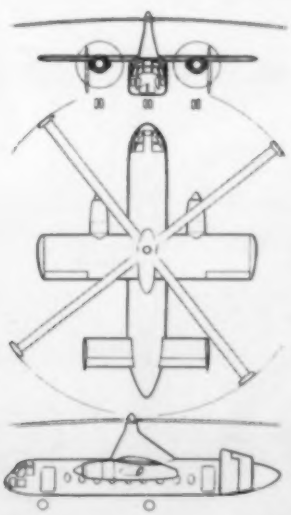
Power plant	Rolls-Royce Derwent
Span	19ft 6½in
Length	26ft 3in

(Data, drawing and photograph are for F.D.1)

FAIREY ROTODYNE The latest news of the Rotodyne—a prototype of which is under construction—is that it will have a maximum, unrestricted, cabin capacity of 3,300 cu ft (the equivalent figure for the standard Bristol 170 is 2,360 cu ft) and carry a payload of 11,000 lb. Earlier information from the makers quoted a passenger capacity of 40, with full baggage allowance (44 lb each); two Napier Eland engines of 3,150 s.h.p.; a fixed wing of 46ft 6in; a 90ft four-blade rotor, with tip-jet propulsion units; an economical cruising speed of not less than 150 m.p.h.; a still-air range of about 250 nautical miles; and an operating cost of 3d per seat-mile at 100 nautical miles (utilization 2,500 hr per annum, 30 kt headwind, 25 min diversion). The Rotodyne will obtain lift for vertical ascent from its rotor, but in forward flight propulsive effort will be progressively transferred to the two airscrews driven by the Elands. About half the lift in this condition will be obtained from the wing, and conventional control surfaces will be used. Under the same conditions the rotor will autorotate, and supply approximately the remaining half of the lift. This system will result in an aircraft capable of vertical ascent and descent but also of a fairly high cruising speed. Numerous military and civil applications are foreseen, and in civil form full twin-engined safety will be provided. The Rotodyne may be the first rotary-wing aircraft to challenge the D.C.-3.

Power plant	Two Napier Eland
Rotor diam.	90ft
Gross weight	23,000 lb





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The Squid

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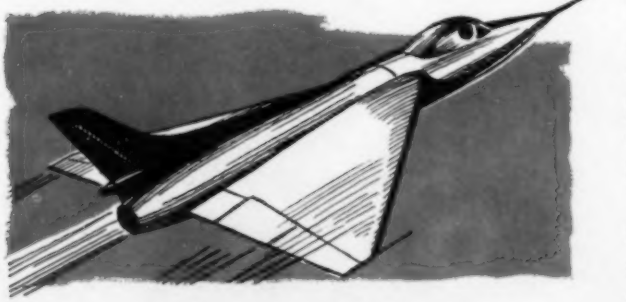
Man devised this technique of locomotion to solve a particular and difficult problem. So did Nature.



The problem was the same: to achieve greater speed. For the squid is a creature of prey. To catch the darting, elusive fish he feeds on he has long clutching arms, lined with suckers and sometimes with teeth and hooks. But none of this elaborate equipment would serve him unless he could move fast.

So Nature adapted the "foot" that all molluscs have (the squid is a kind of mollusc) into a siphon. An "intake" — a slit to the front of the squid's underpart — scoops in water, which is then forcibly ejected through a narrow nozzle by muscular contraction. The velocity of this method of swimming is remarkable. The men of the *Kon-Tiki* saw squids shooting clear of the surface with the power of their jets, and often found them in the morning on the roof of their cabin, where prodigious leaps had landed them during the night.

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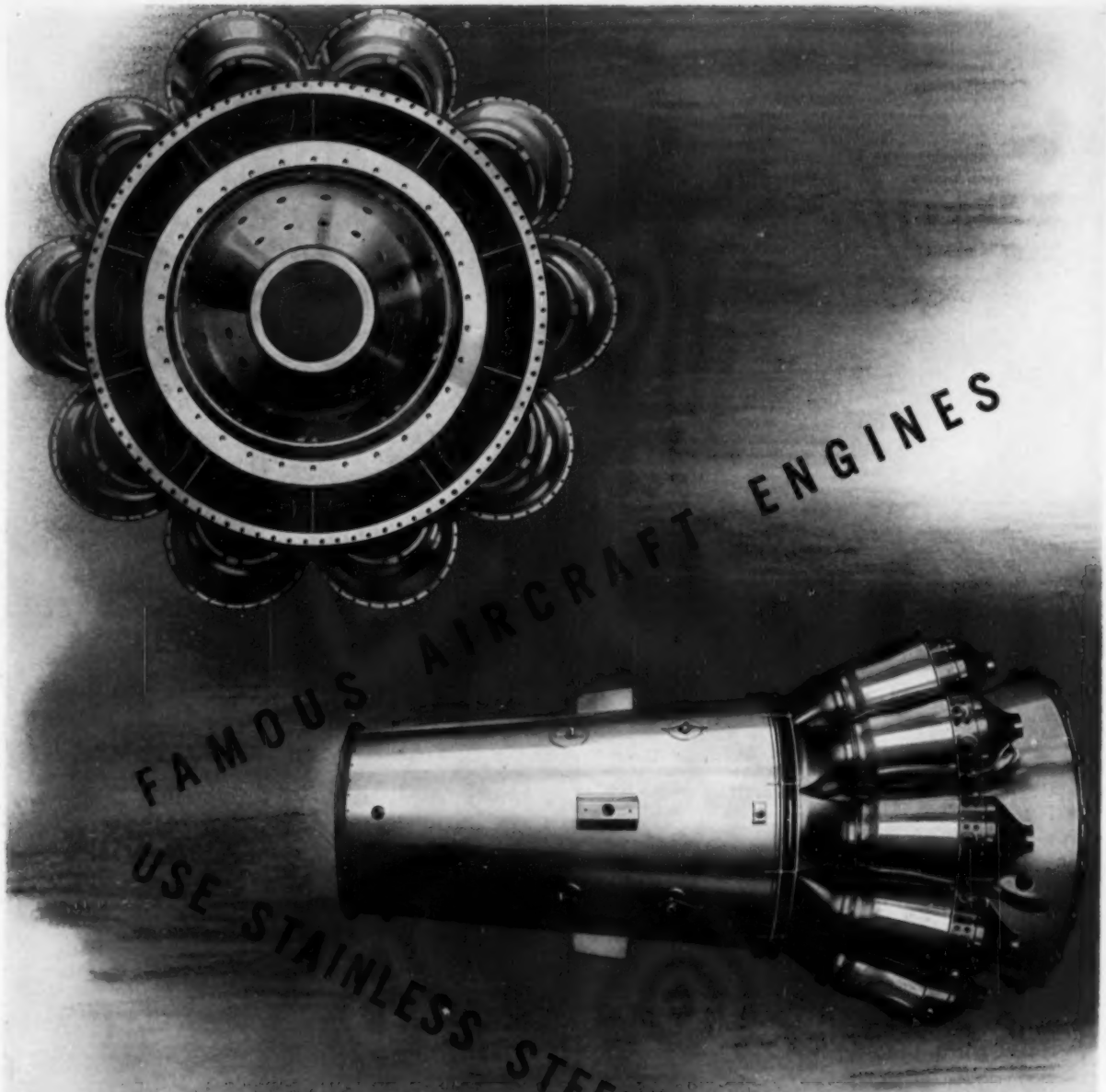

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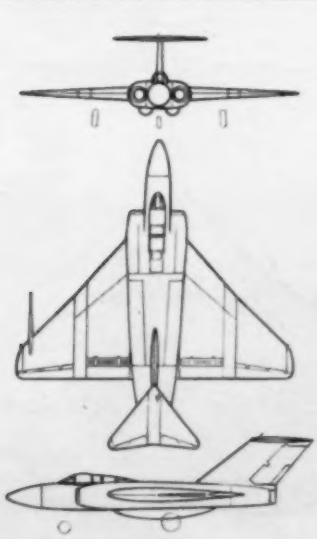
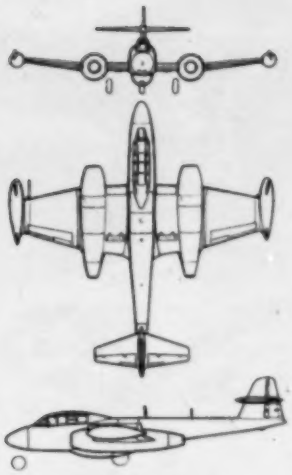
Power plant	A.S. Viper 101
Span	20ft 8in
Length	28ft 9in
Gross weight (as prototype)	about 4,500 lb

FOLLAND MIDGE AND GNAT Though essentially similar in design to the Gnat light fighter, the Midge is merely a prototype, intended to try out the aerodynamic characteristics and services of that type, pending the availability of the Bristol Orpheus turbojet. The Midge itself is powered with an Armstrong Siddeley Viper 101 of only 1,640 lb thrust—about one-third of the thrust of the Orpheus—yet it is capable of exceeding 600 m.p.h. in level flight or of diving at a Mach number better than 1. Remarkable as this is, it is not altogether surprising, having regard to the fine aerodynamic design and small dimensions (span 20ft 8in). The pressurized and air-conditioned cockpit of the Midge is fitted with a Folland-developed lightweight ejector seat and is covered with a single-piece canopy hinged at the rear. Ailerons and rudder are manually controlled, but the all-flying tailplane is hydraulically actuated, with the elevators acting as servos. The hydraulic movement is also over-ridden by an electric screw jack, which is used for trimming. The wing has a very low thickness/chord ratio and a sweep angle of 40 deg at the quarter-chord line; anhedral is pronounced and there are no flaps. Both the Midge and Gnat will carry two 30 mm guns and the Gnat will be capable of operating in the fighter/bomber rôle, equipped with bombs, napalm containers or batteries of air-to-ground rockets. As for handling, it is necessary only to add that on the second flight—of half-an-hour's duration—the Midge did eight rolls.

Power plant	Two A.S. Sapphire
Span	52ft
Length	57ft

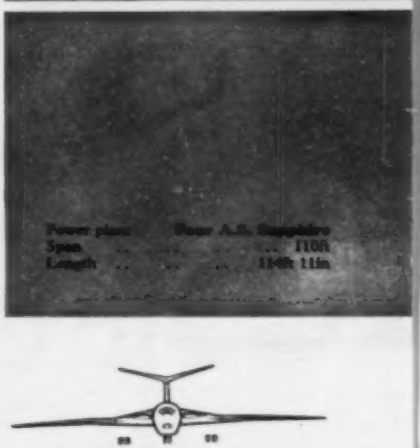


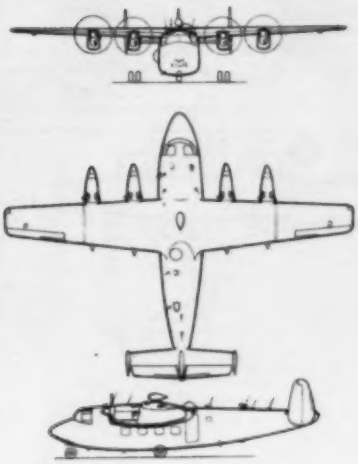
GLOSTER JAVELIN It was announced in August that the delta-wing Javelin two-seater all-weather fighter had been "exceeding the speed of sound for some time," and that it was "likely to be the first British aircraft to carry the newly developed air-to-air guided missiles." Production for the R.A.F. is well under way and at the time of writing it is hoped that five Javelins—the third, fourth and fifth prototypes, and the first and second production machines—will appear in the S.B.A.C. flying display. In its present—FAW.1—form the Javelin is powered with two Armstrong Siddeley Sapphire turbojets, without afterburners, but it is quite obvious that not only afterburners, but even larger turbojets, could be installed if necessary; in fact, the makers claim that the aircraft is capable of using all the increases in engine power that can be anticipated "in the foreseeable future." Many hundreds of hours of development flying have been completed on the prototypes and of these many have been spent at heights in excess of 50,000ft. It is well known that part of the secret of the Javelin's very impressive take-off, climb and landing performance lies in its low wing loading, but the makers also testify to the value of the tailplane, which, being movable in conjunction with the elevators, also ensures good manœuvrability at all altitudes and speeds. Auxiliary fuel tanks can be carried beneath the nacelles for the Sapphires.



GLOSTER METEOR The Meteor to be demonstrated at Farnborough this year is known to the makers as the "P.V. Meteor 7/8" and is a company-owned machine registered G-ANSO. It is composed of the main fuselage, wings and other components of the ground-attack Meteor (from which it inherits the tail surfaces of the Mk 8 fighter) but has the two-seater forward fuselage of the T.7—the famous Meteor trainer version, which has now passed out of production. The wing-tip fuel tanks of the ground-attack machine are retained. (As a point of interest, it may be noted that G-ANSO is at present used by the Gloster Aircraft Co., Ltd., as a "hack" machine for photographic work and other duties in connection with the development of the all-weather Javelin.) Meteor variants in R.A.F. service, apart from the T.7 trainer, are the F.8 single-seat intercepter, the F.R.9, for fighter reconnaissance, the P.R.10 high-altitude photographic reconnaissance machine, and the N.F.11, 12, 13 and 14 night fighters, already dealt with as Armstrong Whitworth types. Although the P.V. ground-attack Meteor, to which reference was previously made, was never built in quantity, Meteor F.8 fighters, armed with rocket projectiles in addition to their normal armament of four 20 mm guns, gave a very good account of themselves in the ground-attack rôle during the Korean campaign. Many squadrons of F.8s remain in R.A.F. service.

HANDLEY PAGE VICTOR It is hoped that the second prototype of the Victor four-jet medium bomber will make its first public appearance at Farnborough this year. Though resembling in all essentials the first prototype, shown in the photograph, it is expected to display certain innovations, notably in tail design, as delineated in the general-arrangement drawing. Power plant of the Victor is four Armstrong Siddeley Sapphire turbojets, largely buried in the innermost sections of the characteristic crescent wing. Other design features include "droop-snoot" leading edges—each in two sections—on the outermost panels; rearward-moving, trailing-edge flaps, shaped to the jet-nacelle contours; and large, hinged air-brake panels (mounted on the tail cone) to increase drag for deceleration in flight and on landing. Early test flights showed the Victor to have a strong tendency to trim nose-up as ground effect came into play, thus conferring valuable "self-landing" characteristics. According to Handley Page's chief test pilot, any pilot can bring the Victor in gently with power on and with flaps and air brakes in operation, in rain or bad visibility; all that is required of him is to correct for local air disturbances affecting lateral trim until the wheels of the main bogie undercarriage touch down. Then the nosewheel is brought on to the runway and the brakes applied.



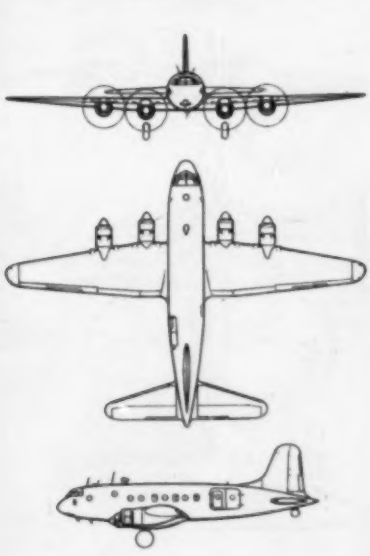


Power plant	Four D.H. Gipsy Queen 70
Span	82ft
Length	52ft 1½in
Max. cont. speed	204 m.p.h.
Gross weight	17,535 lb

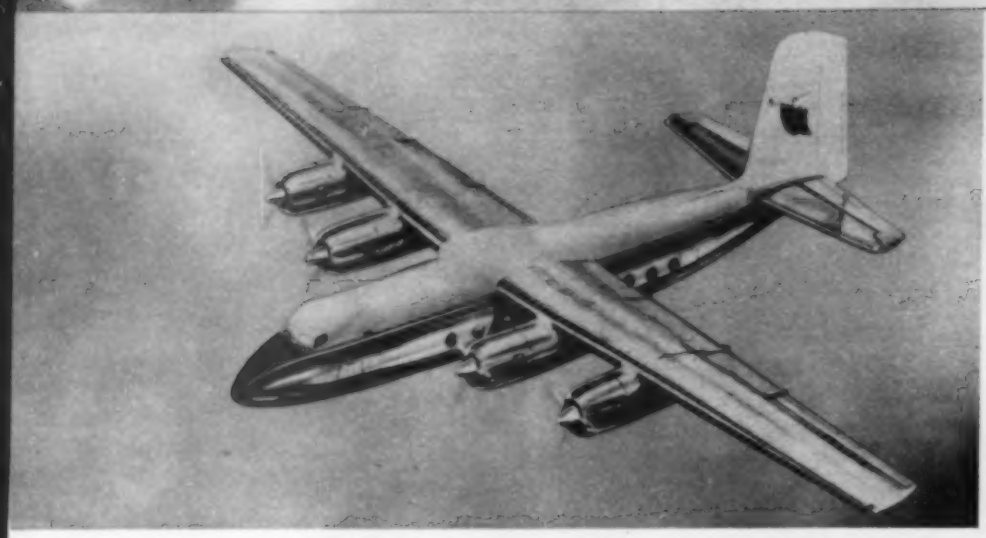
HANDLEY PAGE (READING) MARATHON The navigation trainer version of the Marathon, as in service with the R.A.F., resembles its civil counterpart except in equipment. It has stations for two pupil/navigators, who sit at their plotting tables in sturdy, rearward-facing seats; they work in company with the staff crew of pilot, navigator and signaller. Standard equipment includes Rebecca Mk 4, Gee and radio compasses, and amidships, for ground and stellar observations, are "pear drop" windows and an astrodome. Engines in the Mk 1 version are four Gipsy Queen 70-3s, giving a speed at maximum continuous power of 199 m.p.h. at 8,600ft. The Mk 1A has Gipsy Queen 70-4s and the equivalent speed is 206 m.p.h. at 5,800ft. In the civil field Marathons are operated by Union of Burma Airways, and the latest customer is Far East Airlines, who intend to use two of these machines on Japanese internal routes. Based at Osaka, the Marathons will link the principal cities in the Japanese islands and fly as far distant as Okinawa. Although the design of the Marathon is now several years old, it is a machine with a number of features which are reproduced in the new Herald transport, described overleaf, including a high wing, a remarkably roomy fuselage, and four engines.

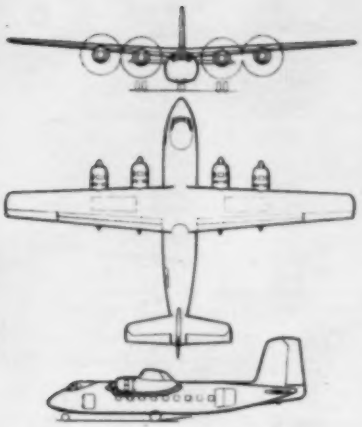
Power plant	Four Bristol Hercules 106
Span	113ft
Length	82ft 1in
Max. speed	348 m.p.h.
Gross weight	90,000 lb

(Data and drawing are for Hastings C.2; photograph shows Hermes IV.)

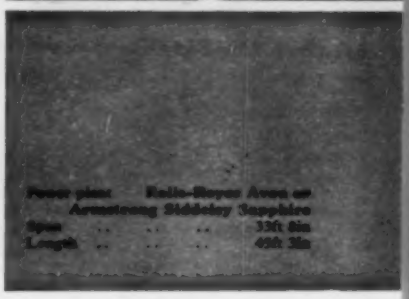


HANDLEY PAGE HERMES IV AND HASTINGS The British Civil Register lists 21 Hermes IVs, all of which were built in 1948-49 for service on B.O.A.C.'s African routes. The majority have subsequently been sold to independent companies for trooping and charter work, including six now flying for Britavia; Airways and Skyways are the other private operators of Hermes. A fleet of four 56-seat tourist-class Hermes remains in service with B.O.A.C., operating three return flights weekly to Nairobi and one to Dar-es-Salaam. The standard Hermes IV is powered by four Hercules 763s developing 2,100 h.p. at take-off; the Hermes IVA has Mk 773s modified to use 100-octane instead of 115/145-octane fuel, enabling the aircraft to operate from a larger number of airfields abroad in return for a slight drop in performance. Of conventional post-war design, the Hermes has a pressurized fuselage, capable of carrying up to 17,000 lb of payload, for which the corresponding still-air range at 10,000ft is 1,345 miles at 268 m.p.h. or 1,588 miles at 212 m.p.h. Whereas the Hermes IV has a nosewheel undercarriage and a fuselage 96ft 10in long, the Hastings—the standard four-engined transport of the R.A.F.—has a shorter fuselage and tail-down undercarriage. In its C.2 form it accommodates 30 paratroops with supplies, 50 fully equipped troops, 32 stretcher cases and 28 sitting wounded, or any of several combinations of freight loads. The C.3 is a special version for the Royal New Zealand Air Force, and the C.4 a special V.I.P. development.

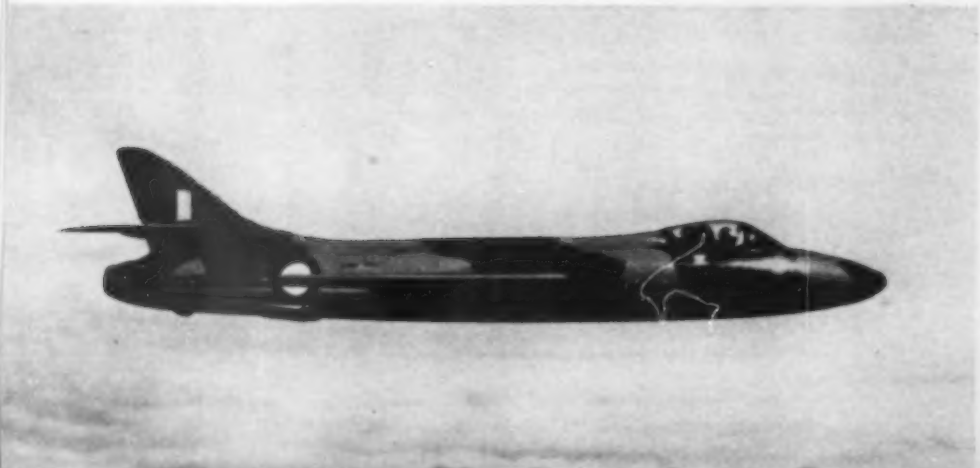


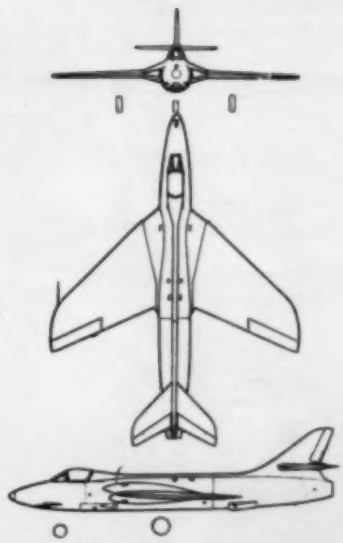


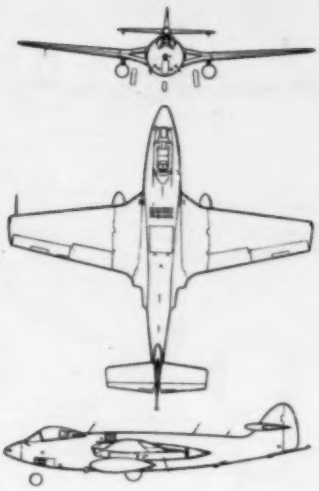
HANDLEY PAGE HERALD Almost every aircraft manufacturer has ideas on the subject of Dakota-replacement, and several have projects under way. Handley Page's formula is expressed in the design of the Herald (formerly known by the type-designation H.P.R.3), which embodies experience distilled from a long and far-ranging survey of operating conditions in six continents. In an important eve-of-Farnborough announcement, the company reveals that two Herald prototypes are being built, of which the first will fly next year; that a production line is being set up; and that deliveries for commercial service will begin in 1957. Basically, the Herald will be a pressurized, high-wing 36-44-seater of all-metal, stressed-skin construction powered by four 870 h.p. Alvis Leonides Major piston engines. At 50 per cent power its cruising speed will be 200 m.p.h. Fuel capacity will be 700 or 1,000 gallons, according to operators' route requirements. A summary of estimated performance shows that over a 750-mile stage, under I.F.R. conditions, the Herald will have an 8,250 lb payload, and that its stage speed will be 183 m.p.h.; the equivalent direct operating costs under these conditions are quoted as £47 per hour, 5s 2d per mile and 1.56d per passenger-mile. The Herald is designated to operate in all climates under comparatively primitive conditions, and will have an exceptional take-off performance; total distance to 50ft (four engines, I.S.A., at 34,000 lb) is estimated to be only 576 yd.



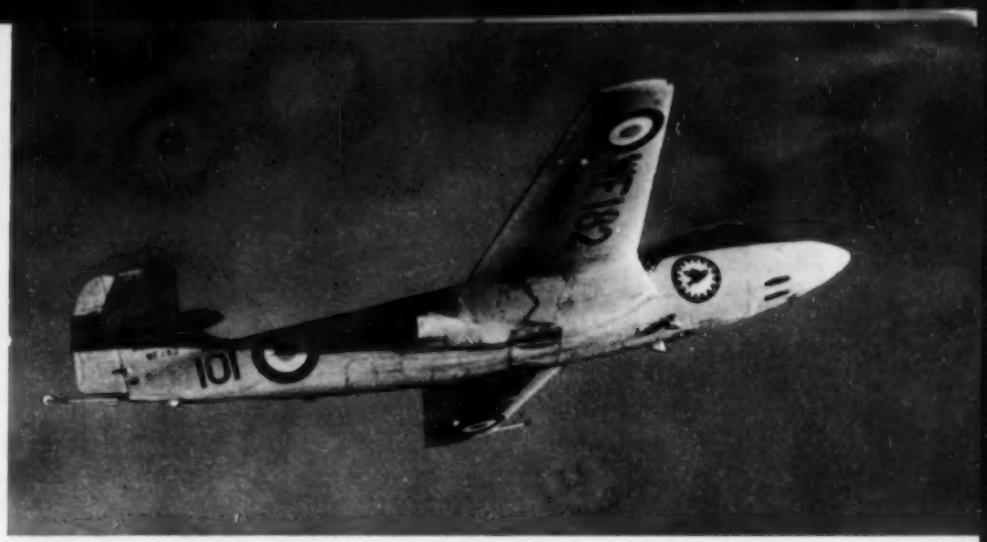
HAWKER HUNTER Overseas orders totalling some £120 million have already been placed for the Hunter single-seat intercepter, and it is claimed that this represents "the greatest-ever sale" of a British aircraft. Holland, Belgium, Denmark and Sweden are the countries concerned, and in the first two of these Hunters are also to be built under licence. The two current marks—F.1 and F.2—are similar except that they are powered respectively with the Rolls-Royce Avon and Armstrong Siddeley Sapphire turbojet. A non-standard Avon-Hunter, fitted with an afterburner, has achieved a speed of 727.6 m.p.h. at low level. Built-in armament is four 30 mm guns, with radar-ranging sight, and for quick, easy rearming and servicing the guns are installed as a "pack." Production aircraft are fitted with a new type of one-piece air brake attached round a segment of the lower rear fuselage, between the wings and tailplane. So fitted, a small number of Hunters participated in the recent large-scale air defence exercises over Britain, and although weather conditions were by no means favourable, attacking bombers are officially stated by the Air Ministry to have been caught "at well over 40,000ft with the greatest of ease." The machines concerned came from the Central Fighter Establishment, but the near future should see a number of R.A.F. squadrons equipping with Hunters. Features which particularly appeal to pilots are the wide field of vision afforded by the forward positioning of the cockpit, and the unusually broad track of the inward-retracting undercarriage.





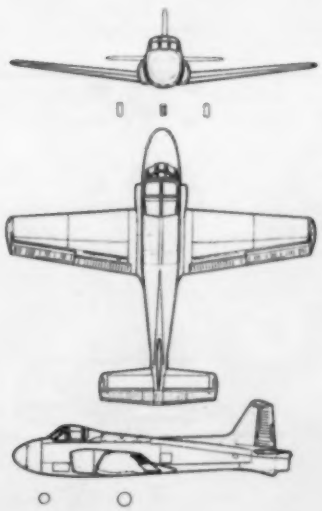


Power plant	Rolls-Royce Nene
Span	39ft
Length	40ft

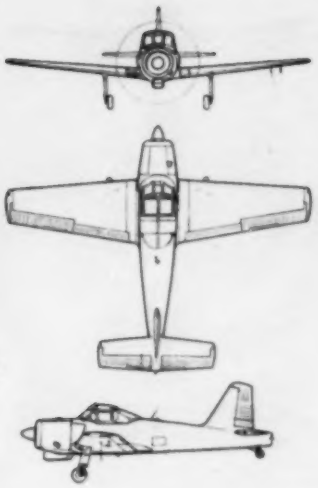


HAWKER SEA HAWK The latest version of the Sea Hawk carrier-borne single seater is the F.B.3 and, as this designation connotes, it is equipped as a fighter/bomber. Externally the machine resembles the earlier versions, which means that it is a very beautiful mid-wing monoplane, with wing-root intakes and bifurcated outlets for its Rolls-Royce Nene turbojet. Indicative of performance is a recent flight by an F.B.3 from London to Amsterdam in 23 min 39.7 sec, representing an average speed of 571 m.p.h. Built-in armament is four 20 mm guns, but obviously the Sea Hawk—like other Naval fighter/bombers—is capable of carrying a formidable load of rockets, bombs or other offensive stores. The Sea Hawk is a very popular aeroplane with pilots. Aileron control is maintained down to and below the stall, at which point there is no wing drop. The cockpit is remarkably roomy, well arranged and quiet, the aircraft is a steady gun platform, and there is no snaking or vibration with air brakes extended. The pressurized cockpit is equipped with oxygen, heating, ventilation, windscreen de-icing, fire-extinguishing systems and a Martin-Baker automatic ejector seat, and the generously proportioned canopy can be jettisoned in conjunction with the seat, or by itself. Sea Hawks are being produced on an extensive scale by Sir W. G. Armstrong Whitworth Aircraft, Ltd., for the Royal Navy and under NATO off-shore contracts.

Power plant	Armstrong Siddeley Viper ASV.3
Span	35ft 5in
Length	31ft 11in
Max. speed	323 m.p.h.
Gross weight	5,950 lb



HUNTING PERCIVAL JET PROVOST The Jet Provost is intended to train pilots from the very outset of their flying career, to carry them through the elementary and basic stages, and to take over a proportion of the syllabus now handled by advanced jet trainers. Many of its structural elements are similar to those of the piston-engined Provost, but the power plant is an Armstrong Siddeley Viper axial turbojet and the undercarriage of nose-wheel type. Air brakes are fitted on the under-surfaces of the mainplanes and lift spoilers on the upper surfaces. Three bag-type fuel tanks are grouped in each mainplane, and provision is made for auxiliary fuel tanks at the wing-tips. The system permits continuous inverted flight for 60 seconds, with power on. The makers maintain that the essential difference between the new trainer and other jet-powered machines for similar work is that, whereas the latter are designed with the primary object of obtaining the maximum possible performance afforded by the selected power plant, the Jet Provost aims at retaining, in the largest possible measure, the safe handling characteristics necessary for initial training, with performance as a secondary requirement. In selecting the power plant their major considerations were to provide a take-off run which would permit the continued use of present training airfields, without calling for runway extensions, and give a fuel consumption which would enable the sortie-duration of the current training syllabus to be flown with comfortable reserves.

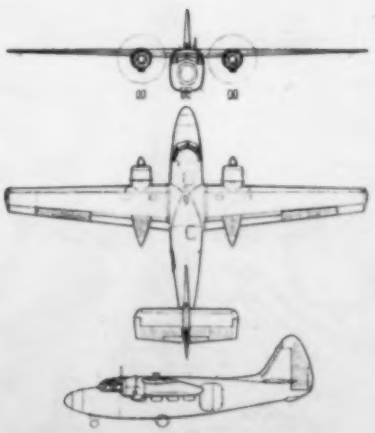


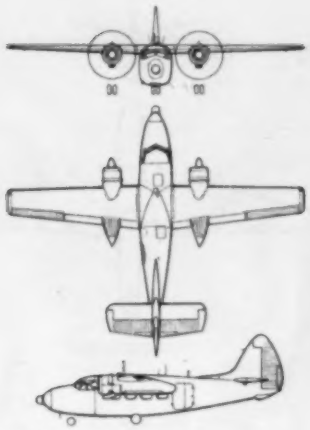
HUNTING PERCIVAL PROVOST The Alvis Leonides-powered Provost is a training aircraft in the very best British tradition, and is one of the key types in the new training programme for the R.A.F.—the second being the Vampire T.11. In April this year *Flight* sought for itself the opinions of personnel engaged on the first Provost/Vampire course, and as a testimony to the Provost we can do no better than quote from our report: "The stand-bys of the old system, the staid Prentice and the rugged Harvard, are steadily being replaced by the new types. The three principal factors in the new order are side-by-side seating all through, the high-powered basic trainer and the turbojet-powered advanced trainer. At first sight, such innovations might appear formidable, but in practice no great difficulties are foreseen. Certainly the Provost has so far given rise to no complaints. . . . Basically the new training schedule is as follows. It begins with 12 weeks of I.T.S. ground training, rather similar to that of the Army's Officer Cadet Training Units, and concerned mainly with personal qualities pertinent to the holding of a commission. This initial warming-up period is followed by a 30-week course on Provosts, covering substantially the same ground as the old Prentice course, but involving 120 hours of flying instead of 65 hours. The acting pilot officer, as the pupil-pilot is now styled, leaves his Provost course with a thorough foundation in the accepted range of ground subjects and a really useful number of hours on a machine which truly qualifies for the name of aeroplane." Illustrated is a Provost T.1 adapted for weapons training.

Power plant	Alvis Leonides
Span	35ft 2in
Length	28ft 8in
Max. speed	200 m.p.h.
Gross weight	6,300 lb

HUNTING PERCIVAL PEMBROKE The Pembroke is a multi-purpose aircraft developed for military purposes from the Prince; it is in full production for the R.A.F. and is being supplied to the Southern Rhodesia Air Force and the Royal Belgian Air Force. Typical operational rôles are the transport of personnel, supplies and equipment; ambulance duties from permanent or improvised airstrips; supply dropping; or twin-engine pilot conversion or training. The R.A.F. Pembroke C.1 is laid out to carry eight passengers in rearward-facing seats for a distance of 575 miles at a cruising speed of 172 m.p.h. at 8,000ft. With the seats removed the aircraft becomes an eminently useful freighter, for the 20ft long unobstructed cabin has a maximum width of 5ft 6in and a maximum height of 6ft, and the cabin doors measure 5ft 2in by 4ft 2in. It is possible, for example, to load a de Havilland Ghost turbojet, which is mounted in the cabin on suitable cradles attached to the floor. The version of the Pembroke ordered by the Belgian Air Force incorporates a number of modifications to extend its sphere of usefulness. Thus, a special nose compartment, and provision for vertical and oblique cameras in the fuselage, permit air survey and general photography. A civil version of the Pembroke, known as the New Prince Series V, is described on the next page.

Power plant	Two Alvis Leonides
Span	64ft 6in
Length	40ft
Max. speed	220 m.p.h.
Gross weight	13,000 lb





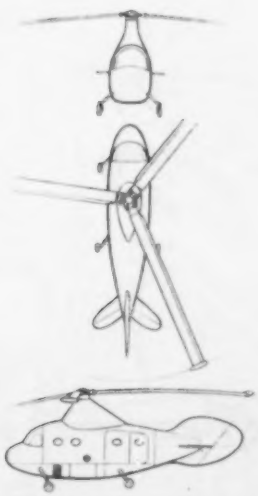
Power plant	Two Alvis Leonides 503 s
Span	56ft
Length	42ft 10in
Gross weight	11,000 lb
Max. speed	230 m.p.h.

(Data for Prince; drawing for Sea Prince.)

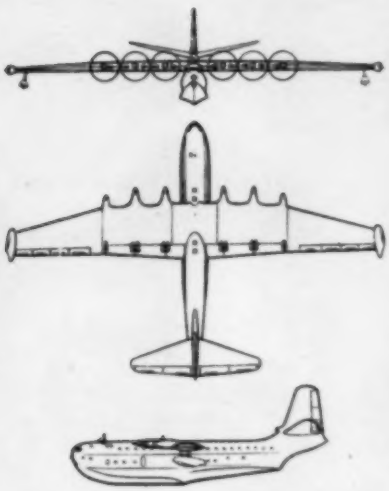
HUNTING PERCIVAL PRINCE Latest of the versatile Prince range is the New Prince Series V, which is offered to operators of charter and feeder services as a 10-seater for stages of up to 650 miles. For shorter distances it will carry 12 passengers, and as an executive transport it is good for a full 1,000 miles. The Series V embodies the longer nose and greater span of the R.A.F. Pembroke already illustrated, and its all-up weight of 12,500 lb is 1,500 lb higher than that of the Prince III. Civil versions of the Prince III have been used over the past four years for a variety of tasks, notably company passenger and freight transport and survey. Six-seat V.I.P. versions have been supplied to the Shell Petroleum Co. and the Standard Motor Co. The Flag Officer (Air) Home has a well-appointed passenger version of the Sea Prince, which is also in service with the Navy as a flying classroom. Three specially equipped Prince IIIBs are used by the M.T.C.A. Flying Unit at Stansted for the calibration of radio aids; this version is identified by the lengthened nose, providing space for cloud/collision warning radar. The Survey Prince, as illustrated, can operate at heights of over 22,000ft, and is equipped to carry all types of modern vertical and oblique cameras. Two 550 h.p. Leonides give the Series III Prince a normal cruising speed of 178 m.p.h.

Power plant	Napier gas-propulsion system
Cruising speed	120 m.p.h.
Gross weight	7,750 lb

(Data and drawing are for P.74; picture shows P.87.)



HUNTING PERCIVAL P.74 AND P.87 The P.74 and P.87, preliminary information on which was released a year ago, are respectively an eight-passenger helicopter and a prospective fixed-wing DC-3 replacement. The helicopter is being built to Ministry of Supply contract and is powered with a Napier high-efficiency, low-pressure, gas-propulsion system which is claimed to avoid all mechanical couplings between the source of power and the rotor. Air ducts feed up on each side of the cabin, the forward part of which has four forward-facing seats and the aft part four rearward-facing seats. The rotor has three blades and is rotated by tip-mounted jets. The makers state that the elimination of the usual cooling arrangements and complicated transmission system will greatly reduce the maintenance and overhaul times. Another feature of the drive, they say, is that it is the quietest available, and they estimate that the noise level will be of the order of 90 decibels at a distance of 100ft and 70 decibels in the cabin. The gross weight is quoted as 7,750 ib and the cruising speed as 120 m.p.h. The essential characteristics of the original P.87 design are shown in a perspective drawing herewith. A development of this aircraft would have 30 seats in its pressure cabin and would weigh about 25,000 lb all-up. The span would be about 92ft, typical cruising speed 265 m.p.h., and full load range 330 miles. Field length would be about 2,700ft, approximate first cost about £110,000, and the machine would operate at about 1s per ton mile.

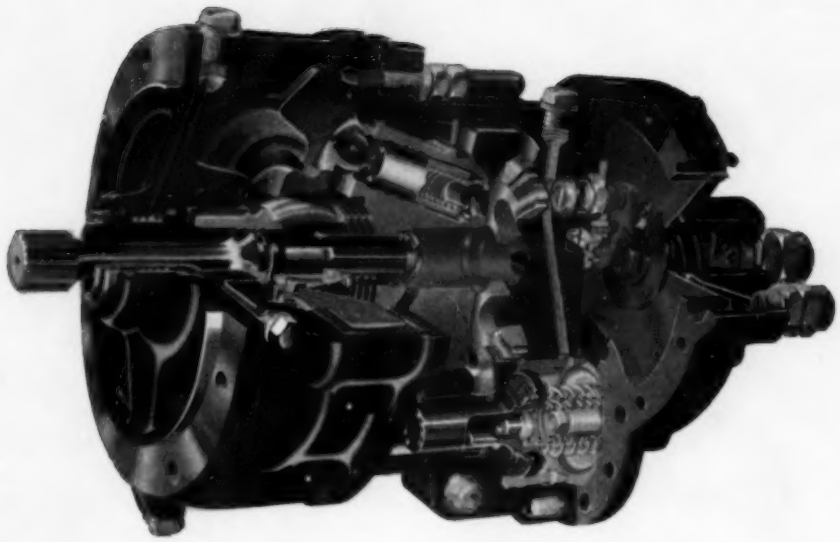


SAUNDERS-ROE S.R.45 PRINCESS Sad to relate, the three Princess flying-ships have been temporarily laid up, pending the development of turboprops more powerful than the early-series Proteus installed for initial flight-testing of the first aircraft. An airscrew-driving derivative of the twin-spool Olympus turbojet might, it is thought, give the Princess a range-speed potential worthy of its immense passenger capacity (well over 100 people could travel in great comfort on the two decks of the double-bubble pressurized hull). Operation and maintenance of the craft would be greatly simplified, since six turboprops of sufficient power would replace the ten units—eight of them in coupled pairs—originally fitted. Two British airline operators have plans for putting the Princesses in commission. B.O.A.C. have outlined a proposal, subject to availability of suitable engines, to fly the Princesses on two major routes: from Southampton to New York, and to Sydney *via* Bermuda and Mexico. The other interested airline is Britain's only flying-boat operator, Aquila Airways, whose operational plan has not been revealed. The company states, however, that it has offered the Ministry of Supply more than £1m for each Princess.

Power plant	Two Bristol Proteus 625
Span	219ft 6in
Length	148ft
Gross weight	320,000 lb

SAUNDERS-ROE SKEETER The smallest helicopter so far developed in Great Britain, the Skeeter is intended for civil and military use. The Mk 3 and 4 were built respectively for the Army and Navy, and, though originally powered with Gipsy Majors, have since been re-engined with the Cirrus Bombardier. A new variant which made its first appearance at the S.B.A.C. Display last year was the Mk 5, intended for civil use and again powered with a Bombardier. The main rotor of the Skeeter has three constant-chord twisted blades, with provision for folding parallel to the rear fuselage. The hub and root portions are the only parts of the machine which cannot be reached from ground level. On the starboard end of the engine (it is mounted athwartships) is a primary gear-box incorporating rotor-engaging and free-wheel clutches and connected by a short intermediate shaft to a secondary gear-box carrying the main rotor shaft. The tail rotor is driven from the secondary gear-box through shafting and bevel-gear boxes. The cyclic pitch stick and rudder pedals are duplicated and the other controls are grouped centrally. The centre fuselage is basically a tubular steel framework enclosing the engine and supporting the main rotor shaft. Attached to it are the front and rear sections, both of conventional sheet-metal construction. The crew of two sit side by side and the observer's seat—to starboard—can be reversed if desired. In its place a 10-gal auxiliary tank may be fitted. The nosewheel undercarriage of the prototype is simple and light, but for certain operations a skid undercarriage may be preferred.

Power plant	Blackburn Cirrus Bombardier
Main rotor diam.	32ft
Fuselage length	28ft 5in
Max. speed	115 m.p.h.
Gross weight	2,100 lb



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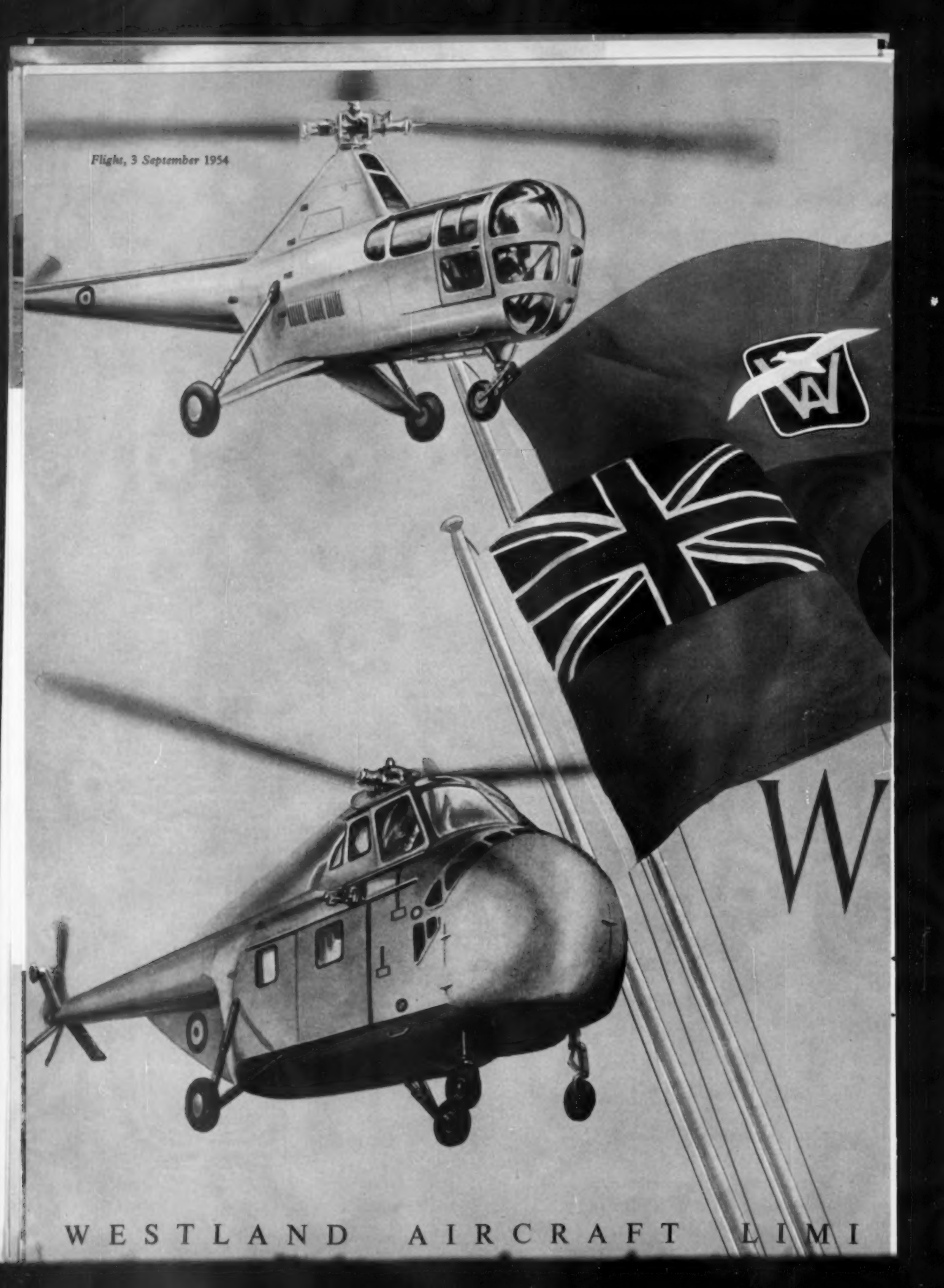

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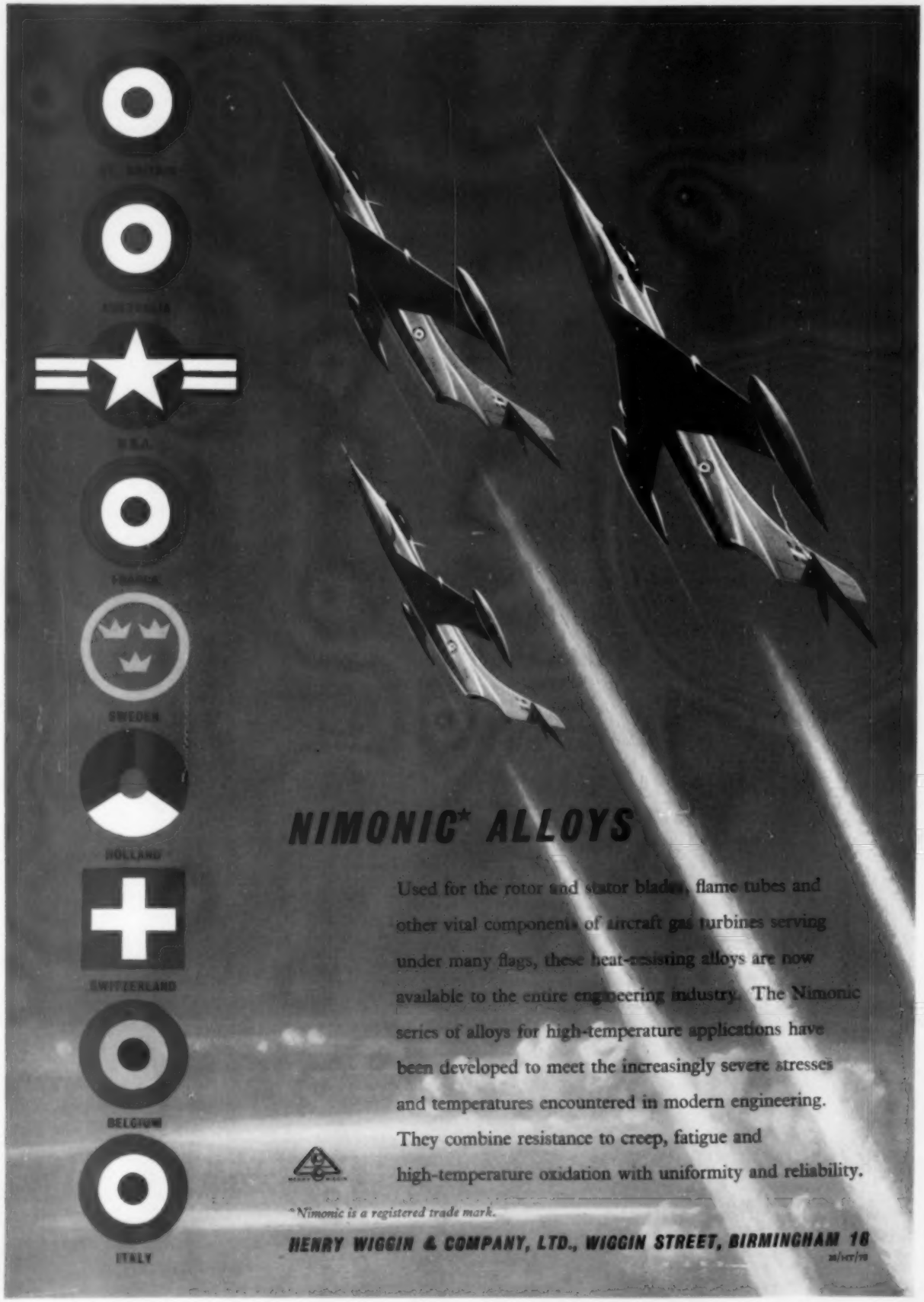
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1934: Handley [illegible] Armstrong-Whitworth, Model [illegible] No.51. Handley Page, Model No.52. [illegible] No.29. Armstrong-Whitworth, Model No.38. 1936. [illegible] -Whitworth, Model No.27. Blackburn "Iris". Short Bros. "Em Phillips & Powis - "Queen Bee". Anson. Gloster "Gauntlet Percival "Mew Gull" and "Vega Gull". Fairey "Battle". 1937 Armstrong-Whitworth "Whitley". Magister Trainer. Supermari "Walrus". Airspeed "Envoy". Blackburn "Skua". Airspeed "Ox de Havilland "Albatross". Fairey "Albacore". 1938: Bristo "Beaufort". Fairey "Fulmar". 1939: the Bristol "Blenheim"

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Armstrong-Whitworth "Albemarle". Fairey "Barracuda". 1940: Westland "Lysander". Boulton Paul "Defiant". de Havilland "Mosquito". Hawker "Hurricane" and "Typhoon". 1941: Fairey

"Firefly". Handley Page "Halifax". 1942: General Aircraft "Hamilcar". Westland "Welkin". 1944: Avro "Lancaster". Bristol "Brigand". de Havilland "Vampire". 1945: Handley Page "Hastings". de Havilland 106. de Havilland "Sea Hor 1947: Avro "Tudor". de Havilland 108. Vickers "Wellington Trainer. Armstrong-Whitworth "Apollo". General Aircraft "Beverley" Freighter. 1948: Cierva "Air Horse". de Havilla "Venom". 1949: Vickers "Viscount". English Electric "Canbe Supermarine "Attacker". Supermarine "Swift". Vickers "Vale Vickers "Varsity". de Havilland "Comet", Series I. 1950: de Havilland 110. 1951: Fairey "Gannet". the de Havilland "Comet", Series Ia. 1952: Gloster "Javelin". the de Havill Series II, "Comet". 1953: Hawker "Hunter". the de Havillan "Comet", Series III.

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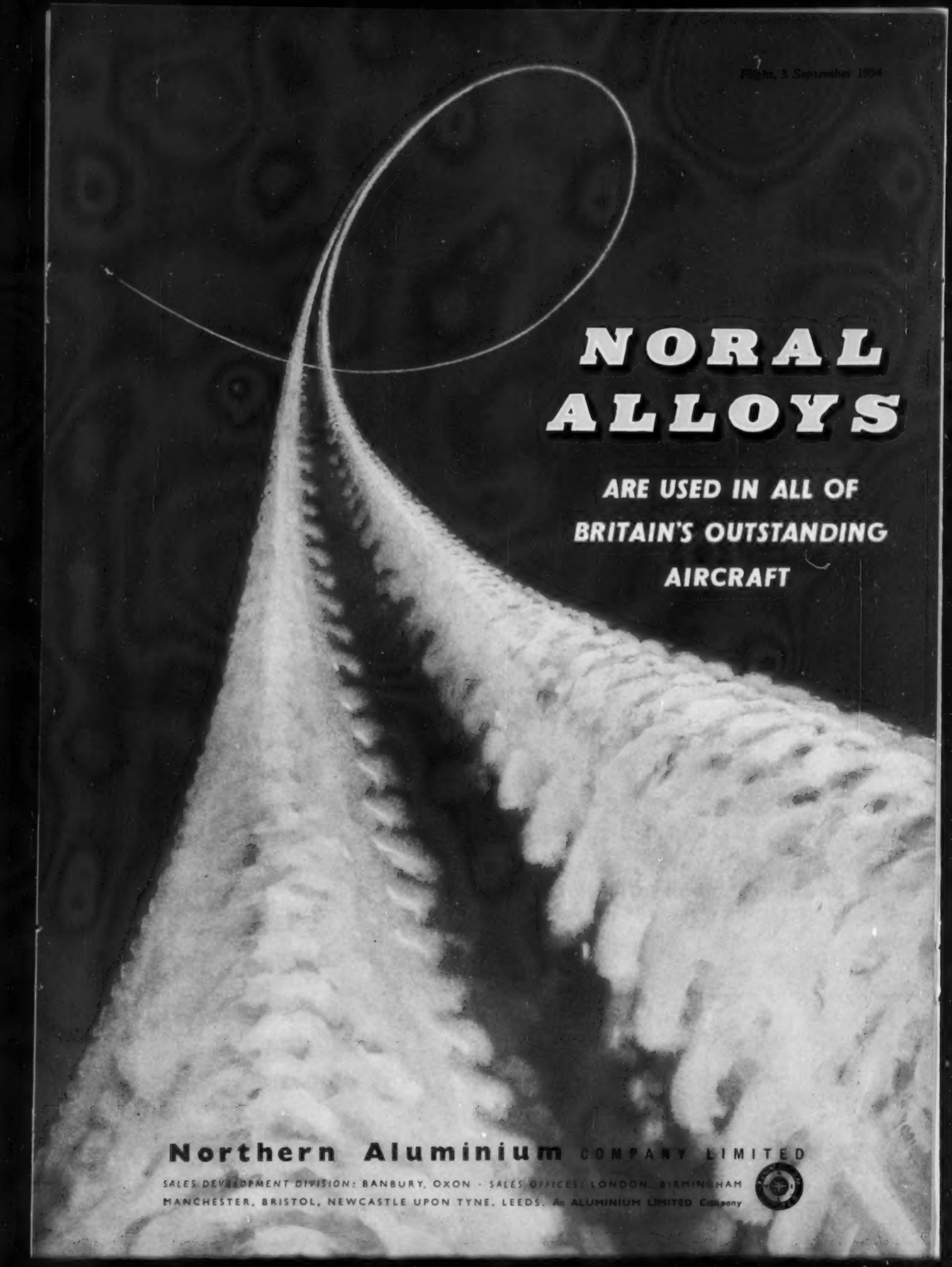

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1934: Handley [illegible], Model [illegible]. 1936: [illegible]
[illegible]strong-Whitworth, [illegible] Page, Model No.52. [illegible] Model No.38. Short Bros. "Em[illegible]" "Gauntlet

simple — rugged — efficient

Seamew Airborne! Mediterranean sunshine, Atlantic overcast—whatever the weather the Short Seamew can take off to conduct an anti-submarine patrol with the most up-to-date radar equipment and use a variety of weapons to effect a kill. Its manoeuvrability, its low stalling speed and the wide range of vision afforded to pilot and observer enable the Seamew to operate in weather conditions impossible for other anti-submarine aircraft. Increased safety in landing back is ensured by the robust, fixed undercarriage with its long travel shock-absorbing oleo legs and two-position tail wheel. The wheels of the Seamew can also be swiftly changed, with differing sizes of tyre to suit the surfaces from which it operates. Simple in design, simple to service and low in initial cost, the Seamew is the Short answer to the need for a tough, economical, all-weather submarine hunter.

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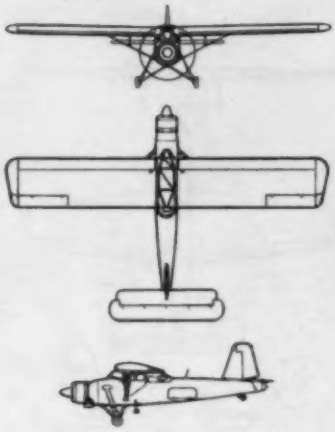
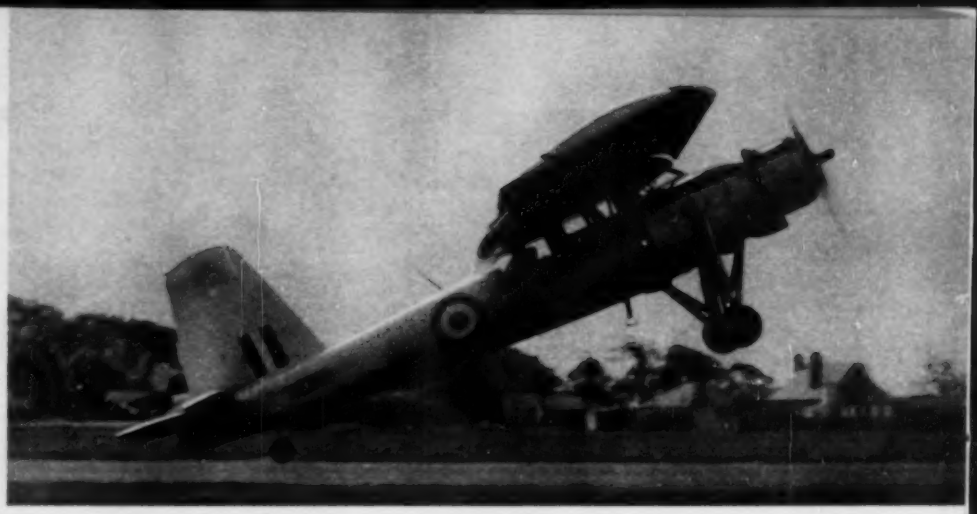


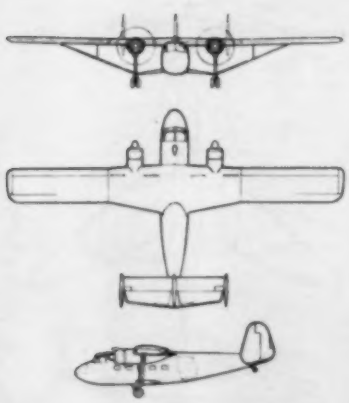


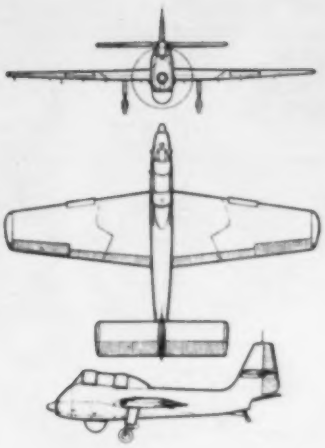
Power plant	Alvis Leonides 501/4
Span	49ft 9in
Length	34ft 6in
Max. speed	162 m.p.h.
Gross weight	5,400 lb

SCOTTISH AVIATION PIONEER 2 For the past year, the R.A.F. has been using Pioneers on ambulance/communication duties in Malaya, where their ability to operate from short airstrips has been of tremendous value. For a normal take-off or landing run, a 50 yd surface is sufficient, and the distance required to clear a 50ft obstacle is only 180 yd. The Pioneer achieves its remarkable performance with the aid of full-span slats and Fowler-type flaps, operated by a single control; trimming is effected with a variable-incidence tailplane, electrically actuated and operated by push switches on the control column. Construction is all-metal, and the Pioneer is designed to operate in any climate. The Mk 2 has a 550 h.p. Alvis Leonides engine, but other units, such as the Gipsy Queen 70 or Wasp Junior, can be installed without difficulty. In standard Leonides-powered form the Pioneer carries a payload of pilot plus four passengers and baggage over a distance of 400 miles at 120 m.p.h., and has the remarkable speed-range of 36-162 m.p.h. Pioneers were delivered direct to the R.A.F. in Malaya without undergoing the usual Service performance and handling trials—a remarkable tribute to the reliability and simplicity of this Scottish aircraft. Data and experience derived from the testing and operation of the Pioneer have been utilized in the design of the Twin Pioneer, described below.

Power plant	Two Alvis Leonides 502/1
Span	76ft 6in
Length	45ft 1in
Max. speed	180 m.p.h.
Gross weight	13,500 lb

SCOTTISH AVIATION TWIN PIONEER The appropriate registration G-ANTP has been allocated to the Twin Pioneer prototype, which should be ready for its first flight within a few weeks. Much of its construction has been undertaken on production tooling, and although the decision to follow this procedure prevents the aircraft from appearing at Farnborough, it should greatly expedite production. A "measure of Government support" is being given to the Twin Pioneer, a 14/16-seater airliner embodying the outstanding features of its single-engined predecessor—simple, metal construction and exceptional small-field performance. Its ability to "unstick" in only 100 yd should enable the Twin Pioneer to bring the benefits of scheduled air transport to many isolated parts of the world, and its progress is being closely watched by many operators forced by geographical conditions to use smaller and less economic types of aircraft. For a machine of such capacity, the proposed cost of £35,000 appears extremely attractive. The Twin Pioneer will be capable of one-man operation, although it has built-in provision for a second crew member. Designed speed-range is 48-180 m.p.h., and the aircraft is intended to operate stages of up to 500-miles with a full passenger complement.



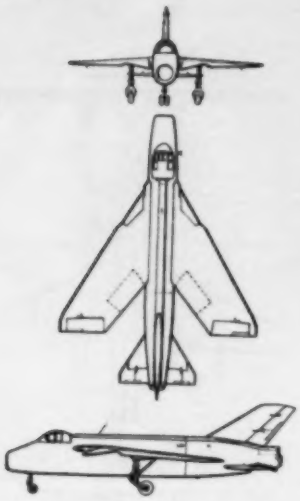


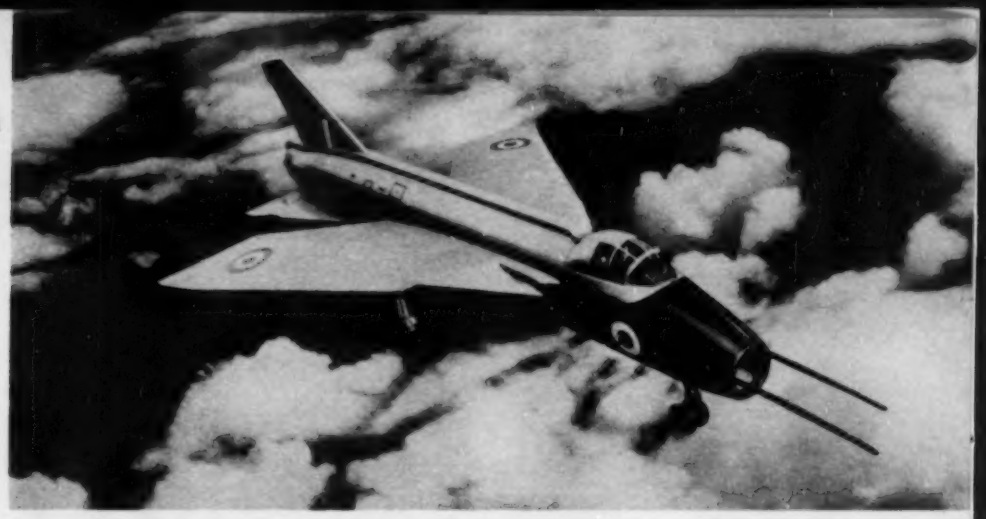
SHORT SEAMEW From technical and operational standpoints the Seamew is one of the most interesting Naval aircraft built since the war. A light, carrier-borne, anti-submarine machine, it is powered by a single Armstrong Siddeley Mamba turboprop and manned by a crew of two. The first flight was made in August last year, after what the makers term "an extremely low weight target" had been substantially beaten. The keynote of the design is cheapness, lightness and simplicity, reconciled with effectiveness, and operation is possible from the smallest carrier, or the roughest emergency strip, in all weathers. Full provision is made for radar and weapons appropriate to search-and-strike operations, in the successful fulfilment of which the exceptionally high standard of manœuvrability, demonstrated at Farnborough last year, must be an important factor. The view from the tandem, high-placed cockpits is likewise of an unusual order. Ingenious design features include a two-position tailwheel by means of which the Seamew lands at a shallow angle of attack. As the wheels touch, a dashpot compresses slowly, so that full compression is reached at the end of a normal carrier landing. A catch then engages automatically to maintain the tail-down position ready for take-off. The undercarriage is fixed, and tyre sizes can easily be changed to suit terrain.

Power plant	Armstrong Siddeley Mamba
Span	55ft.
Length	41ft.

SHORT SHERPA The Sherpa is a purely experimental aircraft, built to prove the possibilities of the "aero-isoclinic" wing. This wing is being developed in the knowledge that flexure of an ordinary swept wing can give rise to torsional instability, tip-stalling, and aileron reversal and flutter at high speeds; it is therefore designed with its flexural axis well aft and with torsional stiffness so adjusted that sufficient nose-up twist is provided to cancel the aerodynamic warping due to flexure. To this end also, wing-tip controllers (elevons) are used in place of the normal trailing edge controls. These controllers comprise about one-fifth of the wing area and are pivoted above a line roughly through the centre of pressure; thus little torsion is imposed on the rest of the wing. Acting as elevators on the rearmost tips of the swept wing, they make it possible to dispense with the usual tailplane and elevators, thus saving weight and drag and reducing the loads which have to be carried by the fuselage. The makers point out that the benefits of these rotating wing-tips are not only structural, for they are expected to prove markedly superior to flap-type controls at transonic speeds. Perhaps their greatest advantage, however, is that they practically prevent the tendency to tip-stalling at low speeds, which can be such a dangerous feature of swept wings. Another point is that the rolling moment of a swept-back wing due to side-slip varies with incidence, and the controllers have the effect of substantially reducing this variation.

Power plant	Two Turbomeca Palas
Span	30ft.
Length	31ft. 10½in.
Gross weight	3,125 lb.



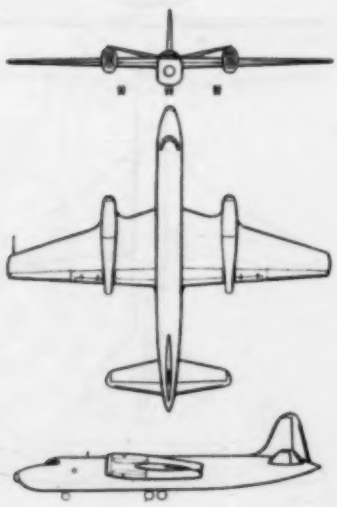


Power plant	Rolls-Royce Derwent
Span	30ft 6in
Length	43ft 9in

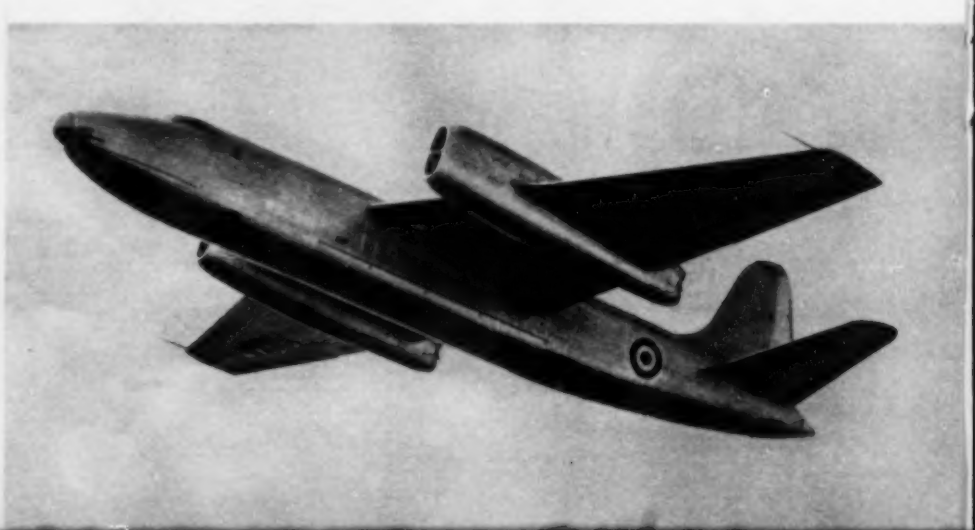
SHORT S.B.5 This extraordinarily interesting research aircraft was designed by Short Brothers and Harland, Ltd., at the request of the Ministry of Supply and in collaboration with the English Electric company. Knowledge gained from it has already been incorporated in the design of the P.1 supersonic intercepter (page 328), and the results of the complete tests will ultimately be made known to the whole of the British aircraft industry. Designed for the investigation of the low-speed characteristics of high-speed swept-wing aircraft, the S.B.5 is so planned that its wings are adjustable to various degrees of sweepback. The angle of incidence of the tailplane can be altered in flight over a range of 10 deg negative to 10 deg positive, and the tailplane can be positioned either at the extreme tip of the fin or at the bottom of the fuselage. Alteration of the mainplane sweepback angle involves little more than a few minutes' work with a spanner. The different configurations which can be tested are: 50 deg wing sweep, high tailplane; 60 deg sweep, high tailplane; 60 deg sweep, low tailplane; 69 deg sweep, high tailplane. Tests in the first two configurations have been completed, and the machine is now flying with 60 deg sweep and low tailplane. With the 69 deg wing the S.B.5 will have a greater degree of sweepback than any other aircraft in the world. It may be noted, incidentally, that the ailerons are straight and that the wing might be described as a delta with "cut-outs" between the ailerons and fuselage. The extremely thin wings are of all-metal construction, with plywood covering over the leading and trailing edges.

Power plant	Four Rolls-Royce Avon
Span	109ft
Length	102.2ft

(Data, drawing and photograph are for S.A.4)



SHORT S.A.4, STURGEON AND SEALAND The S.A.4 jet bomber dates from 1951, since when aircraft of this type have been engaged on high-altitude, high-speed research for the Ministry of Supply. One machine is being used as a flying test-bed for the de Havilland Gyron turbojet, of very high output—a conversion from the standard four-Avon layout which was doubtless facilitated by the unusual disposition of the units in paired installations, wherein one engine is superimposed upon another. The Sturgeon (two Rolls-Royce Merlin engines) was originally designed as a Naval reconnaissance aircraft but has been used by the Royal Navy since 1951 as a high-speed target tug. The newest version no longer carries synchronized photographic equipment—and its operator—as did its forerunner, and it has consequently been possible to shorten the nose by nearly 7ft. The hydraulic wing-folding mechanism has been replaced by manual gear and the RATOG and arrester hook removed. A total weight saving of 680 lb has thus been effected. The Sealand 5/8-seater twin-engined amphibian, powered with two de Havilland Gipsy Queen engines, continues to serve in a number of countries on civil and military duties. It is especially valuable in regions where landing areas are scarce and demands for air transport are varied. All-up weight is 9,100 lb.



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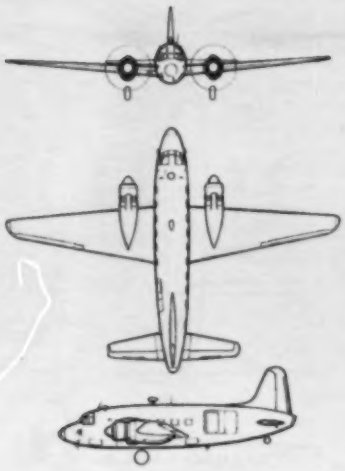
VICKERS-ARMSTRONGS VALIANT The Valiant B.1 will be the first four-jet bomber to enter service with the Royal Air Force—an event which will mark the greatest increment in Britain's offensive strength since the war. The high-mounted wing of this bomber has a mean sweepback of about 20 deg. and the four Rolls-Royce Avon turbojets are installed within its inboard sections. Double-slotted flaps are a feature and these, together with the great output of the four Avon RA.14s and the relatively low wing loading, confer a remarkable take-off performance. Production aircraft, for instance, are being flown from the 1,288-yd runway at Brooklands, and one of these machines—in a lightly loaded condition, be it said—has been airborne in 600 yd in a light wind. There are no leading-edge slats or other attachments, but boundary-layer fences are fitted in line with the inboard ends of the ailerons. The tail surfaces are slightly swept and the undercarriage has paired main wheels in tandem, retracting outwards. A Valiant B.1 prototype, with auxiliary tanks beneath the wings, was entered for (though did not participate in) the England-New Zealand race, and the planned route is indicative of the Valiant's range, for it consisted of only three stages, the longest of which (Cocos Island-Christchurch) was about 5,000 miles. The Valiant B.2 is a special development with a longer fuselage and twin-four-wheel-bogie main undercarriage, housed, when retracted, in prominent fairings behind the trailing edge. This machine has been observed in recent months flying over Southern England at extremely high speeds at very low level, indicating that its structural strength is very great.

Power plant	Four Rolls-Royce Avons
Span	114ft
Length	114ft

(Data and drawing are for B.1; photographs, B.1)

VICKERS-ARMSTRONGS 1000 AND V.C.7 It was announced in June this year that the Vickers-Armstrongs Type 1000 would be the future standard long-range transport of the British Services in succession to the Handley Page Hastings, and that a Government order had been placed which would enable the manufacturers to begin economical production in series. *Flight* remarked at the time that, apart from re-affirming faith in high-speed, high-altitude transport aircraft, this order marked a welcome change in the status and relative importance of British military air transport on a global basis. The Vickers company was authorized to go ahead with the construction of a prototype Type 1000 in February last year, and this machine is already recognizable. It is a much bigger aircraft than the Valiant and the fuselage is fully 146ft long—greater even than the span of the aircraft. A low-wing single-deck machine, it is to be powered with four Rolls-Royce Conway by-pass engines buried in the inner sections of the wing, the leading edges of which have sharp sweepback. The V.C.7 will be a civil derivative of the Type 1000 and will weigh well over 200,000 lb. It should carry 120 passengers in first-class comfort over the North Atlantic from London to New York in a matter of seven hours, for the Conways will confer remarkable fuel economy as well as very high speed. A prototype of the V.C.7 is expected to fly next year.

Power plant	Four Rolls-Royce Conway
Span	140ft
Length	146ft



Power plant	Two Rolls-Royce Elbe Mk 101
Span	93ft 0in
Length	67ft 6in
Max. speed	290 m.p.h.
Gross weight	57,900 lb

(Data and photograph for Varsity; drawing, Valetta)

VICKERS-ARMSTRONGS VARSITY AND VALETTA In the R.A.F. the Varsity T.1 is a standard "flying classroom" for the training of aircrew, and its specified rôles are air navigation/bomb-aiming, pilot-training, and signals training. There is an underslung cell between the flight deck and the wing spar which can contain twenty-four 25 lb practice bombs and provides also a side-by-side bomb-aiming station for the instructor and pupil. Aft of the spar is a combined station for two pupils, operating H2S radar, with a separate seat for an instructor. If needed, accommodation can be provided for four additional pupils. The Varsity differs from the Viking and Valetta, from which it was developed, in having a nosewheel undercarriage. It is also a somewhat larger and more powerful aircraft. The Valetta is used in the R.A.F. in three forms—C.1, C.2 and T.3. The C.1 is a multi-purpose transport for troops, freight, paratroop and supply dropping and ambulance work; the C.2 is a special V.I.P. version seating from nine to fifteen passengers and having additional fuel tanks; and the T.3 is a special navigational "flying classroom," with six astrodomes strung out along the top of the fuselage. The Valetta has a large freight-loading door measuring 8ft 6in × 8ft 6in × 5ft 8in in the port side of the fuselage. The main cabin offers a volume of 1,565 cu ft and has a specially strengthened floor.

Power plant	Four Dart R.Da 6
Span	93ft 6in
Length	81ft 2in
Gross weight	56,000 lb

VICKERS-ARMSTRONGS VISCOUNT 700 The brilliant success of the Viscount, both operationally and commercially, has been one of the most heartening aspects of post-war British aviation. At the time of writing sixteen airlines had firmly ordered 143 Viscounts and hold options on a further 24. Other orders are under negotiation, and may well have been clinched by the time these words appear. Since the type entered service with B.E.A. 18 months ago, its flying hours have reached a total of 40,000, and among air travellers the name Viscount has become synonymous with smooth and fast inter-city travel (Viscounts hold a score of European route records). Production is undertaken at Hurn, near Bournemouth, where output is rapidly building up to a rate of eight aircraft monthly. Credit for the Viscount's ascendancy in the world airliner market is, of course, shared between Vickers-Armstrongs and Rolls-Royce, makers of the Dart turboprop. Overhaul period of the Dart has been increased from 400 to 750 hr and is expected to reach four figures by the end of the year. Meanwhile, the engine's performance has been further improved; developing 1,550 h.p. at take-off, the new Dart 6 not only has 150 h.p. more than the existing Dart 3, but lower fuel consumption also. As a result, the maximum range of the Viscount 700D with full payload of 12,800 lb will increase from 1,100 to 1,450 miles (1,655 miles when the new external "slipper" tanks are fitted) and its average cruising speed (320 m.p.h.) will show a gain of 17 m.p.h. Accompanying data apply to this version.

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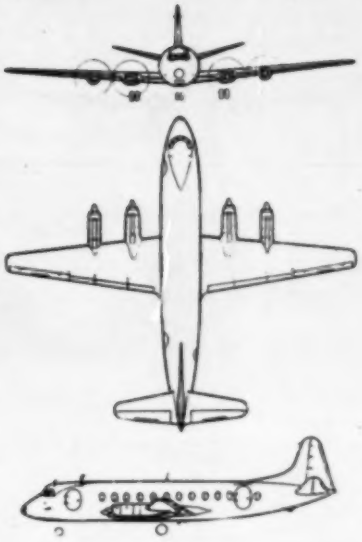


VICKERS-ARMSTRONGS VISCOUNT DEVELOPMENT Early in 1953 it was announced that B.E.A. had signed a £4m contract for 12 Viscount 801s—specialized short-haul versions identified by a 12ft 4in fuselage extension. The specification, however, has since been revised; the type has been re-designated 802, and the proposed "stretch" reduced to 3ft 10in. Even so, this additional fuselage length (which will be built in ahead of the wing) will, when coupled with re-positioning of the forward bulkhead, enable the Viscount 802 to carry two more rows of seats. Passenger capacity will thus be increased to a maximum of 70. This new version, of which first deliveries will begin next year, is intended to be complementary to the earlier series, rather than a successor: it will offer lower seat-mile costs over the shorter, denser stages of B.E.A.'s large network without incurring the extra spares, maintenance and training costs associated with the operation of basically different types of aircraft. A prototype 802 will not be required, and the Hurn production line is equipped to build the slightly longer fuselages without re-tooling. No official pronouncement has been made on the subject of a successor to the Viscount; it is believed, however, that Vickers-Armstrongs are thinking in terms of a 100-seater airliner with four 4,000 h.p. turbo-props of an advanced type, giving a speed of around 500 m.p.h.

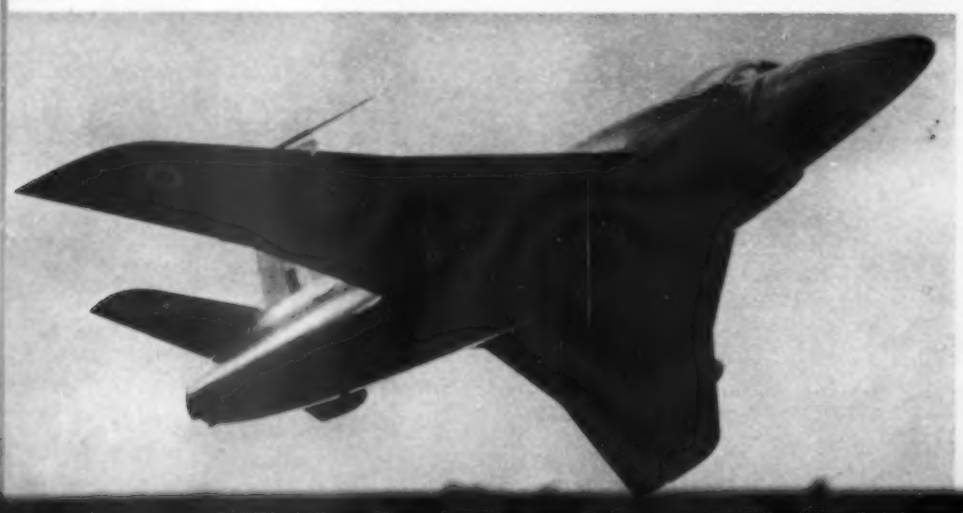
Power plant	Four Rolls-Royce Dart R.Da6
Span	93ft 8½in
Length	82ft

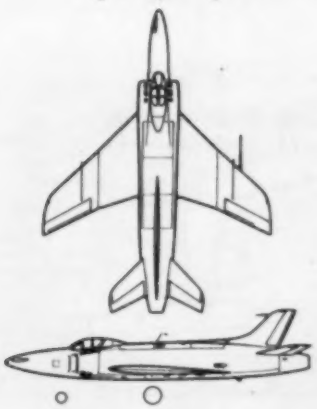
(Drawings and data for Viscount 800)

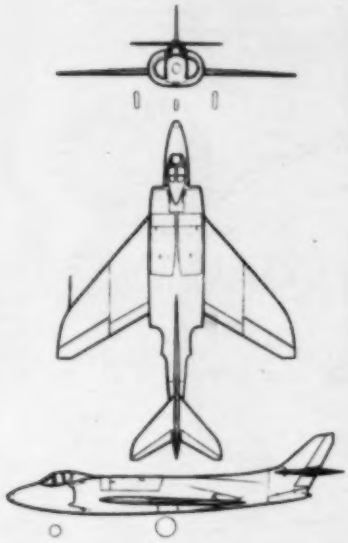
VICKERS-SUPERMARINE SWIFT Mention of five variants of the Avon-powered, single-seater Swift has been authorized to date. The F.1 has a fixed tailplane, two guns, and no afterburner; the F.2 is similar but has four Aden guns; the F.3 has only two guns, but is fitted with an afterburner; the F.4—the current production type for fighter squadrons of the R.A.F.—has an afterburner, movable tailplane and four guns; and the F.R.5 is a fighter/reconnaissance version with a lengthened nose, a taller fin, and provision for forward-facing and oblique cameras. The Minister ... Supply has made it known that the Swift F.4 is capable of bringing to bear eight times more high explosive than was possible with earlier types of guns, for the Aden has about twice the rate of fire of the 20 mm Hispano gun, standard fighter weapon of the R.A.F. since 1941. The Swift is a descendant of—and successor in production to—the straight-wing Attacker, used as a standard carrier-borne fighter/bomber by the Fleet Air Arm and also serving from land bases with the Royal Pakistan Air Force. Whereas the Attacker, when powered with a Rolls-Royce Nene 4 turbojet, achieves a maximum speed of 583 m.p.h., the swept-wing, Avon-powered Swift established a world's record last year of 735.7 m.p.h. in level flight, and has flown from London to Paris at an average of 669 m.p.h. The massive fuselage of the Swift must hold an impressive quantity of fuel and external tanks are possible fitments.

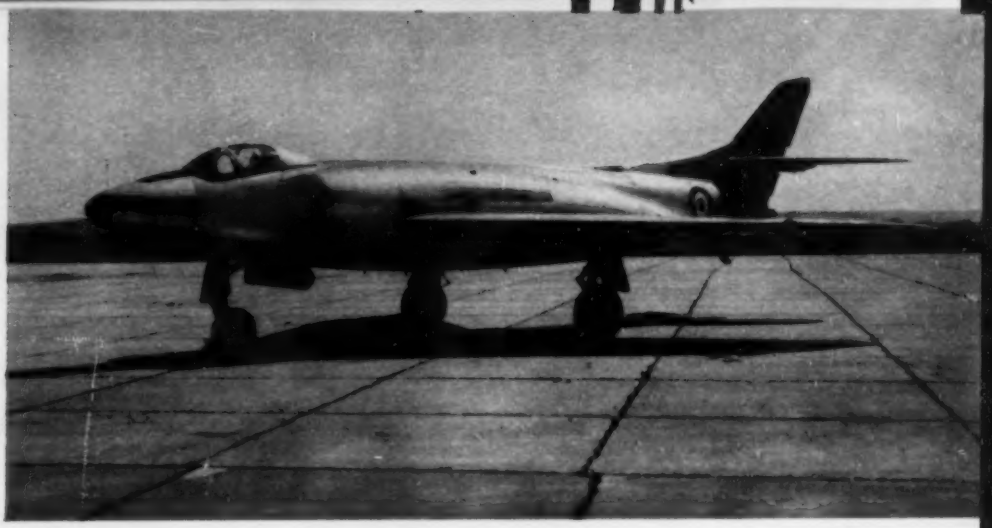
Power plant	Rolls-Royce Avon
Span	32ft 4in
Length	41ft 6in

(Drawing shows F.R.5; photograph and data, F.4)







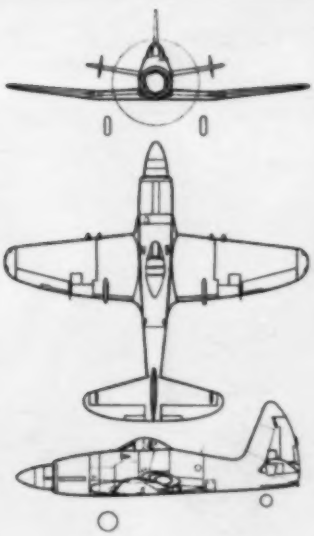


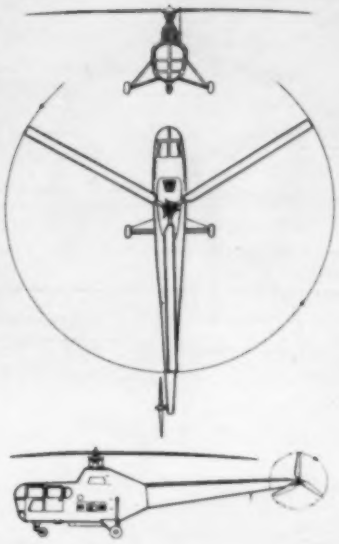
VICKERS-SUPERMARINE TYPE 525 This carrier-borne, twin-jet, single-seat intercepter fighter is an interim development towards an even more advanced type to be produced in quantity for the Fleet Air Arm. The prototype flew for the first time in May this year, and is a derivative of the Types 508 and 529 previously seen in the S.B.A.C. Display; but whereas those designs had a straight wing, of very thin section, and a vee-type tail, the 525 has swept mainplanes—likewise very thin—and a more conventional tail, with sweep-back on horizontal and vertical surfaces. The pilot's cockpit is placed far forward in the fuse-lage, on each side of which, slightly to the rear, are the lateral intakes for the two Rolls-Royce Avon turbojets; the tailpipes emerge just aft of the trailing edge of the wing. Afterburners are not fitted. There is a retractable tail skid in addition to the nosewheel, and a sting-type arrester hook in the extreme tail; a housing for a tail braking parachute is discernible aft of the tailplane attachment. Armament of the developed 525-type fighter has not been made known, but the 508 and 529 appear to mount four 30 mm guns in the bottom of the power plant housings. With its tremendous thrust and—apparently—ample wing area, a fighter of the 525 type should be able to carry heavy loads of external stores, including atomic weapons.

Power plant	Two Rolls-Royce Avon
Span	38ft 6in (approx.)
Length	55ft (approx.)

Power plant	Armstrong Siddeley Python
Span	44ft
Length	41ft 10in

WESTLAND WYVERN It seems probable that the Wyvern S.4 will be the last airscrew-driven strike aircraft—apart from specialized anti-submarine types—to be adopted for the Fleet Air Arm. Certainly there is a tendency in the American Navy to prefer the pure-jet machine for the attack of land and sea targets. Meanwhile, however, the Wyvern forms the equipment of a Fleet Air Arm squadron, pilots of which have demonstrated in the past few months its speed and manœuvrability, even when carrying a heavy war load. Demonstrations at previous S.B.A.C. Displays, of course, had already eliminated any doubt on those scores. The power plant of the Wyvern S.4 is the Armstrong Siddeley Python turboprop, which drives an eight-blade Rotol contra-rotating airscrew. Built-in armament is four 20 mm wing-mounted guns, and external provision is made for a torpedo, bombs, rocket projectiles, mines or depth charges. Youngman hydraulically operated flaps are fitted on the inner wing, and there are dive brakes on the outer panels. Seated very high in the fuselage and, in consquence, having a wide field of view for deck landing and attack, the pilot is provided with a Martin-Baker ejection seat. Performance details of the S.4 are withheld, but the Wyvern T.F.1, with a Rolls-Royce Eagle piston engine, achieved 455 m.p.h. That the Python-engined development has a superior performance is hardly to be doubted.



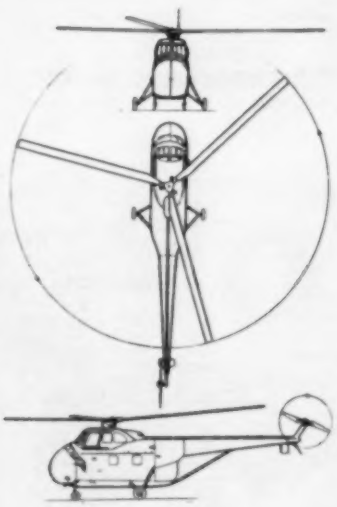


WESTLAND-SIKORSKY S-51 Known to the Navy and the R.A.F. as the Dragonfly, the S-51 is produced at Yeovil under a licence agreement concluded in 1947 between Westland and Sikorsky. American production ended in 1951 after more than 300 Wasp Junior-powered machines had been built. To date, more than 130 have been produced by Westland for both military and civil operators, and Yeovil-built S-51s have logged over 30,000 hr. The type is powered by a 550 h.p. Alvis Leonides engine giving a sea-level maximum speed of 115 m.p.h.; the still-air range at a cruising speed of 86 m.p.h. is 308 miles. In the normal passenger version a sliding door on the starboard side of the cabin gives access to a bench-type seat for three people; another door, on the port side, is provided for the pilot, who sits centrally well forward in the glazed nose. Military versions can also carry two stretcher patients in panniers (which, although externally mounted, enclose the occupant completely), and for rescue work are equipped with a pilot-controlled hoist capable of lifting 375 lb. The S-51 can also be used for crop-spraying or -dusting. Standard features which distinguish the Westland-built S-51 are, in addition to the more powerful engine, the fitting of all-metal main rotor blades and of hydraulic servo controls. The airframe is built in three main assemblies: cabin, with nosewheel; centre-section, including mainwheels, rotor-head and power-plant; and tail-cone.

Power plant	One Alvis Leonides
Rotor diam.	49ft
Fuselage length	41ft 11in
Max. speed	115 m.p.h.
Gross weight	5,700 lb

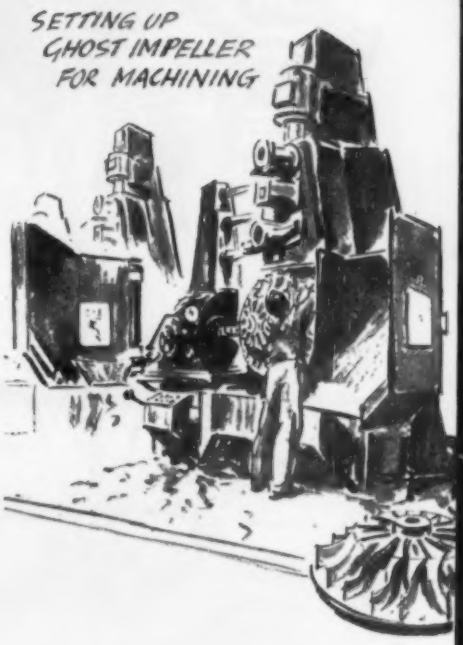
WESTLAND-SIKORSKY S-55 More than half-a-million S-55 flying hours have been logged since the prototype made its first flight five years ago. Used on a large scale by the American forces, American-built S-55s are also serving with four airlines, including Sabena, and are used for non-scheduled commercial work. In Britain, Westland are building S-55 Whirlwinds for the Navy and recently received an order from B.E.A. for two float-equipped versions. Carrying six passengers with baggage, these will be used to operate regular 22-minute services between the South Bank rotorstation and London Airport. Proving flights are expected to begin in November. Normal capacity of the S-55 is for 10-12 passengers, or six stretcher cases; alternatively, almost a ton of freight can be carried. Dual control is provided for the two-man crew. Its standard power unit, mounted in the nose with "clamshell" doors for easy access, is a 600 h.p. Wasp; later British versions, however, are intended to employ the 800 h.p. Leonides Major. The 800 h.p. Wright Cyclone is yet a third possibility. Hydraulic servos for both azimuth and collective-pitch control, and an aerofoil trimmer aft of the tail cone, contribute towards remarkably good handling qualities. Normal range of the S-55 is about 460 miles, although with ferry tanks this can be extended to more than 1,000 miles.

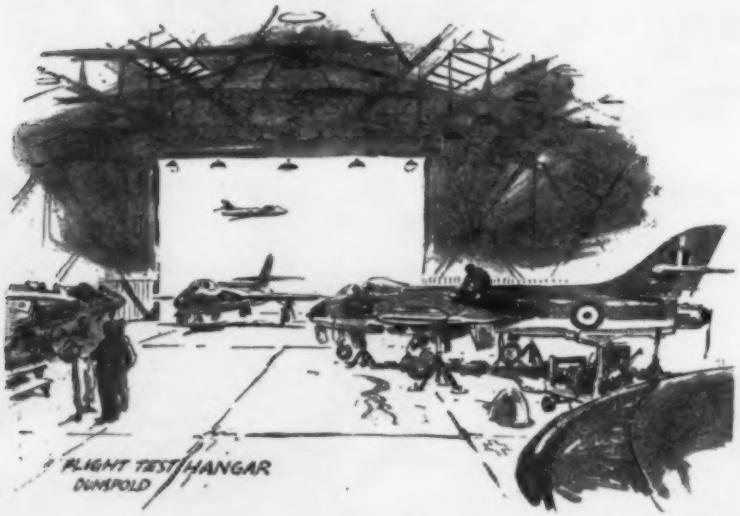
Powerplant	One P. & W. Wasp R-1340
Rotor diam.	53ft
Fuselage length	41ft 8in
Max. speed	110 m.p.h.
Gross weight	7,500 lb

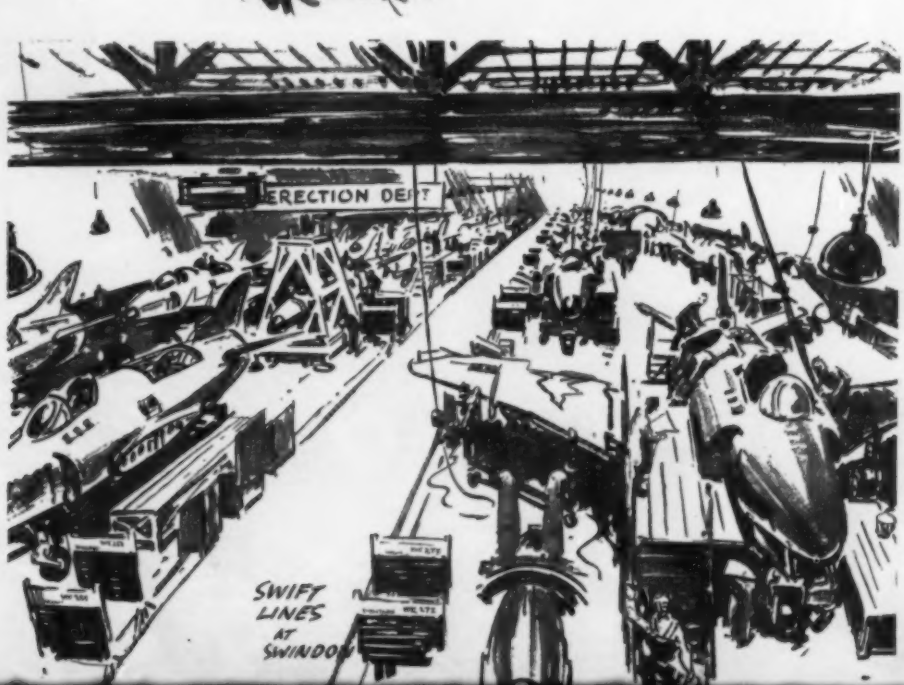


BEHIND THE SHOP FRONT

ARTISTS being licensed to do such things, we step with Gordon Horner through the Farnborough front window, duck under the counter and take a brisk turn through the workshops. A rare privilege this, for the doors are opened to us (cautiously but benignly) by the Ministry of Supply, and there is a welcome from all the makers we call on: from Hawkers and Glosters—two of the nine Hawker Siddeley companies; from Bristols and de Havillands, in their airframe and engine shops; from the sister firms of Vickers and Supermarine and Hunting Percival. We take in at a glance (for the Ministry frowns upon loiterers) something of design, production, research and testing, and are reminded that the world's best aeroplanes do not just grow on trees, though when they are seen clustered together on a sunny morning at Farnborough, this might seem possible. Our present hosts are rivalled by a dozen or more firms, no less hospitable. They will not be piqued that we are unable to look in just now. As for the Woomera wilderness, it appears by virtue of the licence we mentioned.





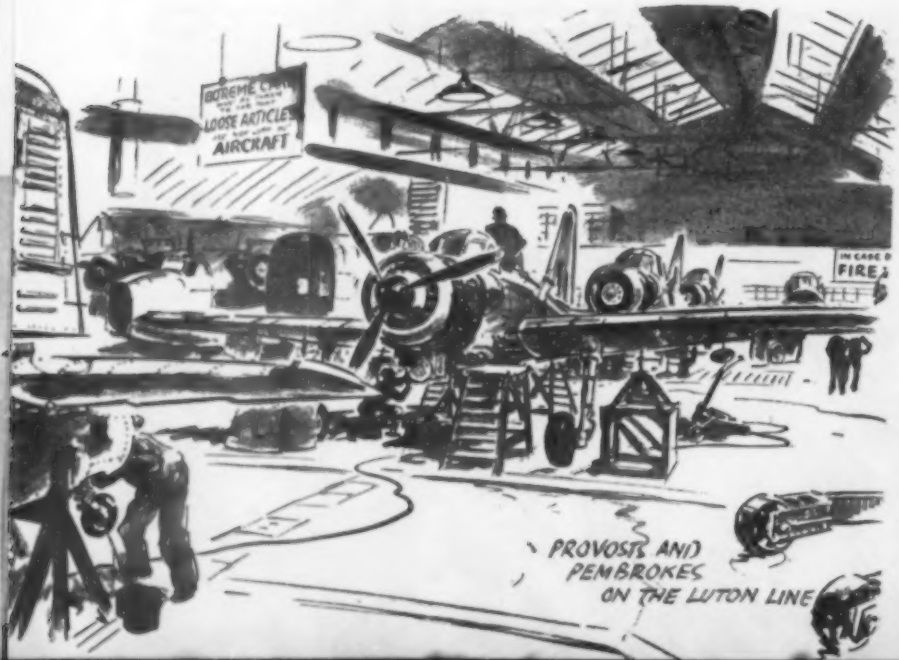


ASSEMBLY OF GOBLINS AT LEAVESDEN

DUNSFOLD TOWER
- CLEAR FOR TAKE-OFF

BEHIND THE SHOP FRONT...

BLACK VALIANT IN THE RAIN
- WISLEY

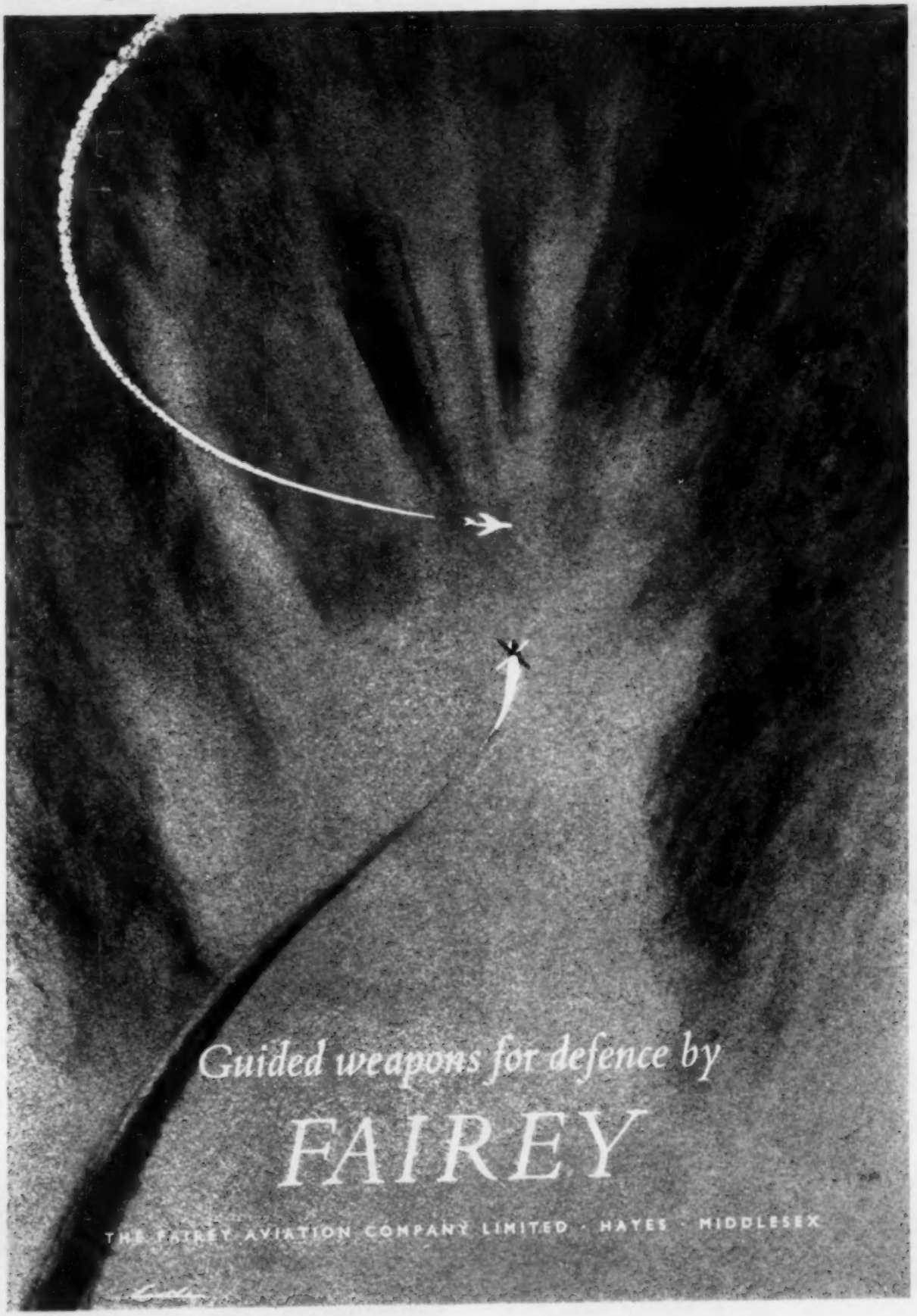


PROVOSTS AND PEMBROKES ON THE LUTON LINE

"FLIGHT"
Copyright
Sketches

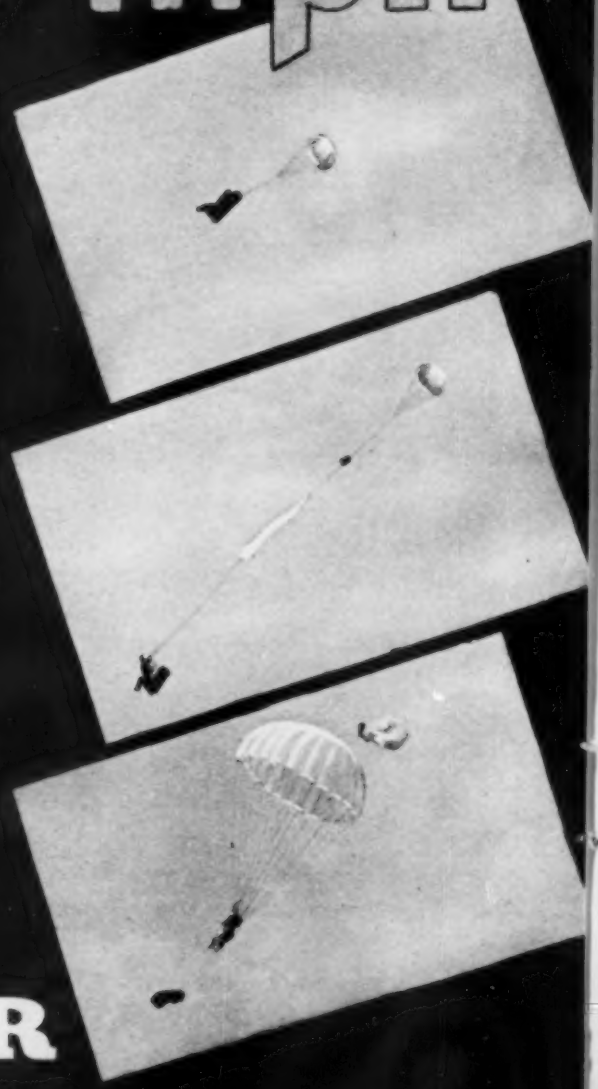
By
GORDON HORNER

BEHIND THE SHOP FRONT...


Guided weapons for defence by
FAIREY
THE FAIREY AVIATION COMPANY LIMITED · HAYES · MIDDLESEX

at low altitudes each second is vital

150 ft. 600 mph



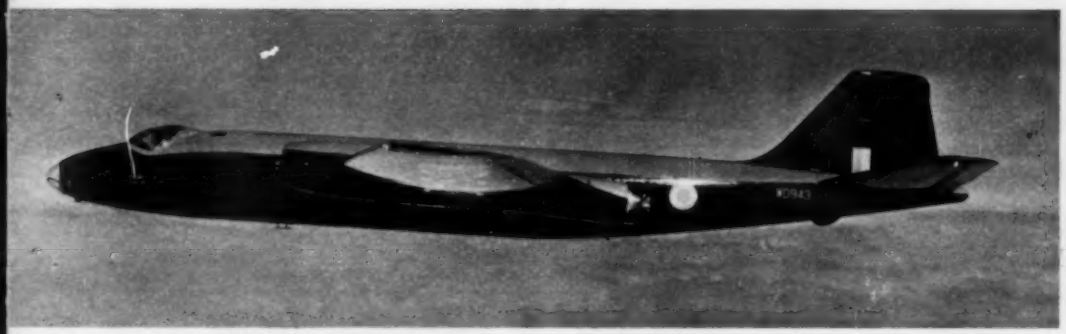
On the 17th March, 1954, an ejection in straight level flight was made from a Meteor 7 aircraft with the Martin-Baker Patent fully Automatic Ejection Seat.

- The speed 600 m.p.h., the height only 150 feet.
- One second after ejection, drogue developed holding seat steady and slowing it down.
- Three seconds after ejection, parachute fully developed with 80 feet in hand.

Patented in the principal countries of the world and certain patents pending.

MARTIN-BAKER

AIRCRAFT COMPANY LIMITED HIGHER DENHAM NEAR UXBRIDGE MIDDLESEX



(Top left) Armstrong Siddeley Sapphire-Canberra, before re-engining with the new Sapphire 7s.

(Above) Bristol Olympus-Canberra.

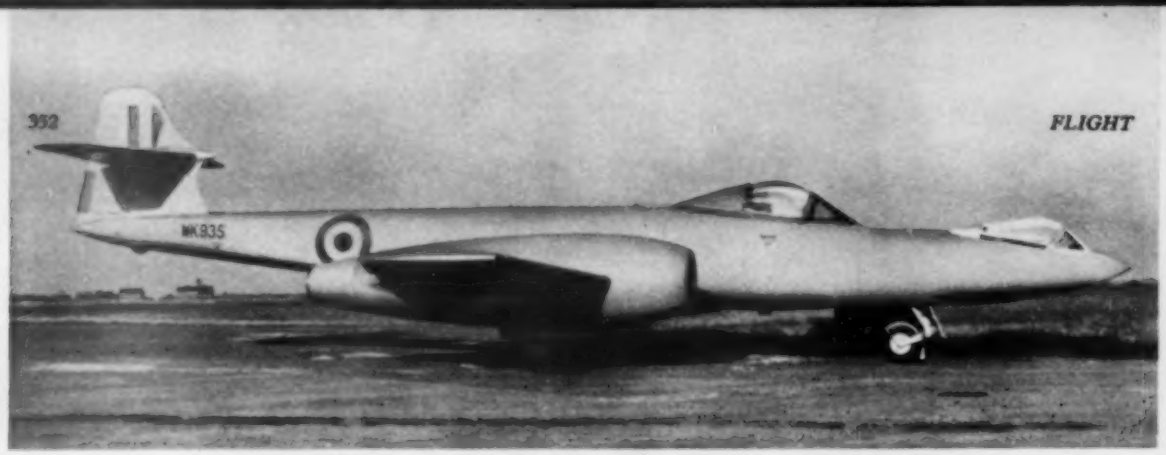
(Left) Rolls-Royce Avon-Canberra.

BRITISH AIRCRAFT 1954

Research and Development

IN recognition of their valuable services, a few representative types of aircraft employed on research and development work of various kinds are illustrated on this and the following page. The three black and grey Canberras at the top of this page are flying test-beds for high-powered turbojets. Seen climbing steeply from take-off is Armstrong Siddeley's **Sapphire-Canberra;** another Canberra is used by Armstrong Siddeley to test a reheat version of the Sapphire. At top right is Bristol's mighty **Olympus-Canberra,** holder of the world's altitude record at a mark of 63,668ft; then comes Rolls-Royce's **Reheat Avon-Canberra,** likewise capable of attaining heights of over 60,000ft. Not illustrated are Rolls-Royce's **Soar-Meteor,** with two Soars at the wing-tips, in addition to the normal Derwents; Bristol's **Proteus-Ambassador;** Napier's **Eland-Varsity** and **Nomad-Shackleton;** Armstrong Siddeley's **Double Mamba Y.B.1** and **Viper-Canberra** (a Viper is installed on one wing-tip in addition to the main turbojets); some older conversions of the **Lancaster, Lancastrian** and the **Lincoln,** and the Handley Page **Sapphire-Hastings.** For various types of high-altitude research the Ministry of Supply acquired six examples of the Avro **Ashton,** one of which is seen flying on the right, and for miscellaneous research and development duties two prototypes of the Armstrong Whitworth **Apollo** are doing good work. Last on this page is the Fairey **Jet Gyrodyne,** a conversion of the original Gyrodyne, which had a mechanically driven rotor, to probe under practical conditions some of the problems associated with tip-jet propulsion of helicopters. The engine is an Alvis Leonides, which drives compressors to supply compressed air

(Above) Avro Ashton, (below) Fairey Jet Gyrodyne.



Armstrong Whitworth Prone-Pilot Meteor.

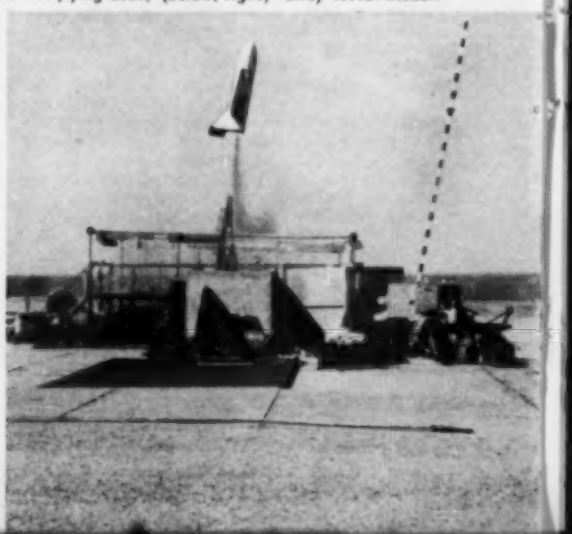
Vickers-Supermarine Type 508.

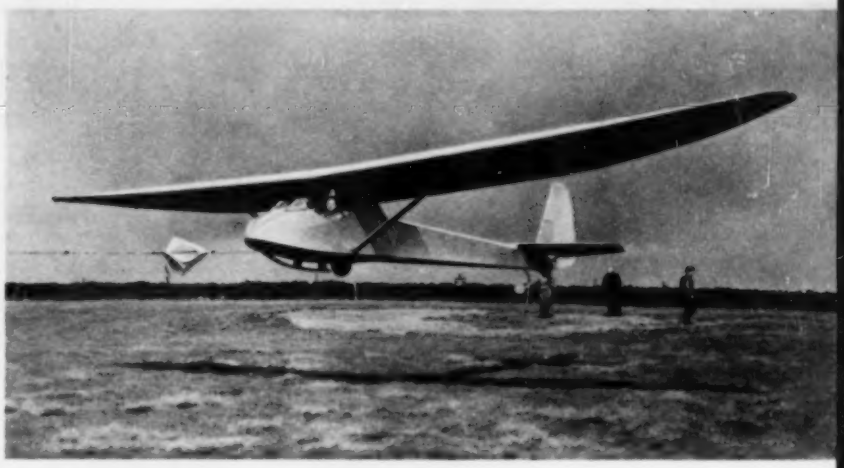
Research and Development

through the hollow rotor blades to the Fairey-designed pressure jets. This machine is being used as a research vehicle for the great Rotodyne, described on page 330.

Heading the research and development aircraft on this page is the Armstrong Whitworth **Prone-Pilot Meteor**—longest of all the pencil-slim A.W. Meteor family by reason of the experimental prone-piloting position in the nose. Further to the rear there is a cockpit with conventional seating for a second pilot. Seen on the deck of H.M.S. *Eagle* is the **Supermarine 508** twin-Avon fighter, which has been used for special deck-landing trials, as have the swept-wing **Supermarine 510** and **Hawker P.1052**. The piston-engined machine seen in three-quarter rear view is the Fairey **Firefly 8** wireless-controlled drone which, as remarked on page 330, might be used for a variety of purposes. The scale-model flying-boat represents a **Saunders-Roe** design for a long-range ocean-patrol machine capable of being operated in mid-Atlantic conditions. Dynamic models of this sort give exact scale behaviour and are a major feature of the company's hydrodynamic research. Having all the characteristics of the full-scale aircraft, they are catapulted into a tank in which any known water conditions can be simulated. A number of other scale models, representing high-speed, water-based fighters and including recent designs utilizing the hydro-ski principle, have also been tested by Saunders-Roe. Last, seen ascending from its launching ramp at Woomera, is a **Fairey V.T.O.** (vertical take-off) model. The striped post assists in recording initial acceleration, which is provided by two 600 lb-thrust booster rockets. The main power source is from two 900 lb-thrust chambers of the Fairey Beta 1 liquid-fuel rocket unit. It was earlier remarked that the V.T.O. model is in all essentials a replica of the F.D.1 delta-wing fighter-research aircraft, which is scheduled to fly in the S.B.A.C. Display this year.

(Above) Fairey Firefly Mk 8; (below, left) scale model of Saunders-Roe flying-boat; (below, right) Fairey V.T.O. model.





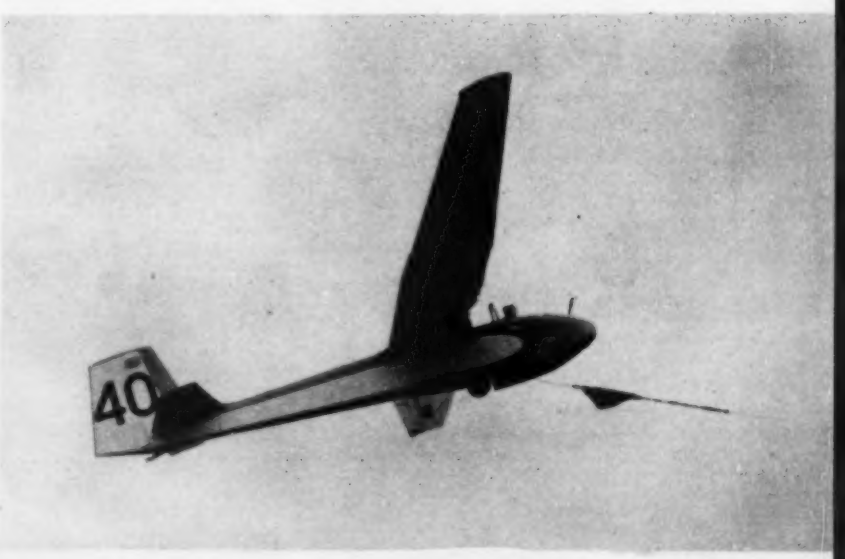
HOST to many countries at this year's International Championships, Britain has a number of interesting developments under way in the field of unpowered flight. Four of the six representative sailplanes shown in this section are new, and two of them took part in the championships. New laminar-flow wing designs and the use of new materials are being investigated, although the development of plastic wings is temporarily slowed. Meanwhile, the products of the British glider industry continue to earn much in the export market. At home, the prospect of high-performance two-seaters and a relatively inexpensive single-seat sailplane for club use in the future gives good reason for optimism.

BRITISH AIRCRAFT 1954 *Sailplanes and Gliders*

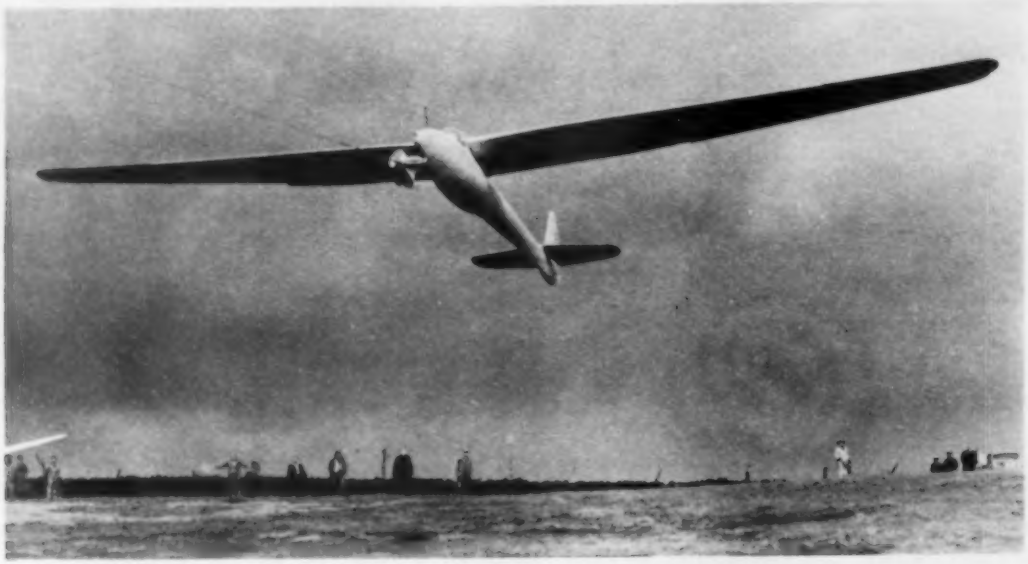
Slingsby T.21B Sedbergh Widely used as a standard *ab initio* trainer by both civilian clubs and Service gliding schools, the T.21B has shown on occasion a soaring ability not expected in instructional gliders. One notable example was the record two-seater flight to 17,000ft by F/L. Alan Piggott made during last year's National competitions. Its side-by-side seating makes dual instruction a straightforward process, either in the prototype machine without windscreen (flown by the London Gliding Club), the standard two-windscreen model shown in the photograph, or in the special fully-enclosed version successfully —and comfortably—used at Lasham by the Surrey Flying Club group. The T.21's friendly ability to forgive mistakes has doubtless been experienced by the majority of recruits to gliding in recent years. For *ab initio* and elementary soaring instruction, the T.21 (known to the Service as the Sedbergh) is a most suitable type which will continue to fly its circuits—and more —in most parts of the world for many years to come. Over 200 have already been sold. Span 54ft, length 26ft 8in, aspect ratio 11.2:1, all-up weight 1,050 lb.

Slingsby Skylark 2 Following the Slingsby company's experience with the Sky, it was decided to meet the need of clubs and private syndicates for a smaller, cheaper sailplane of good all-round performance. The prototype T.37 Skylark appeared in 1953, and was flown in this year's World Gliding Championships by Pat Beatty of South Africa. Manufacture of the production version, the T.41, is now proceeding, to orders of both foreign and British customers. An unusual constructional feature of the sailplane is the three-piece wing (two outer panels being attached to the centre section, instead of the previously normal two-piece method), adopted for ease of assembly and transport. The design otherwise follows conventional practice, with the use of a number of glass-fibre components. Span 48ft, aspect ratio 16:1, length 24ft 6in, all-up weight 600 lb.

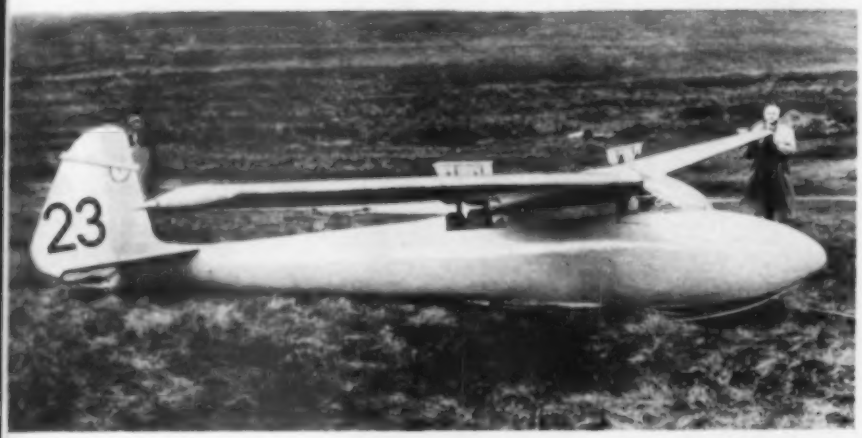
Slingsby T.42 This tandem two-seater, intended to serve as an advanced club trainer for cross-country flying and soaring, made its first public appearance at the World Championships at Great Hucklow in July, flown by Lorne and Ann Welch. The fact that it was ready in time for the championships reflects the enthusiasm and hard work of the Slingsby team; that no major snags arose during test flying or the period of the contests emphasizes the basic soundness of the design. This design is essentially conventional, the structure being entirely of wood, and incorporates the three-piece wing-assembly method used on the Skylark. The beautifully



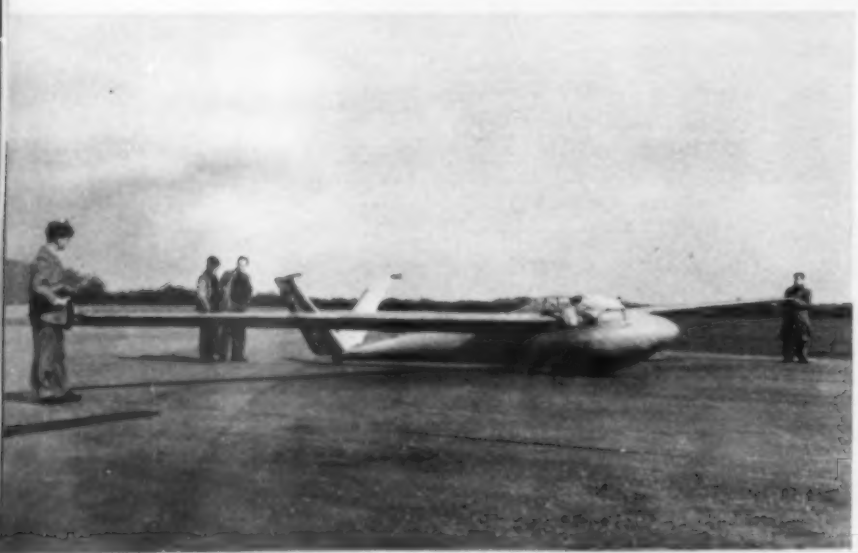
(Top) Slingsby T.21B Sedbergh, (above) Slingsby Skylark 2, (below) Slingsby T.42.



Slingsby Sky.



(Above) Eon Olympia 4, (below) Kendall K.1.



Sailplanes and Gliders

made one-piece Perspex canopy is of Slingsby manufacture. Span 58ft, aspect ratio 14:1, length 26ft 9in, all-up weight 1,100 lb.

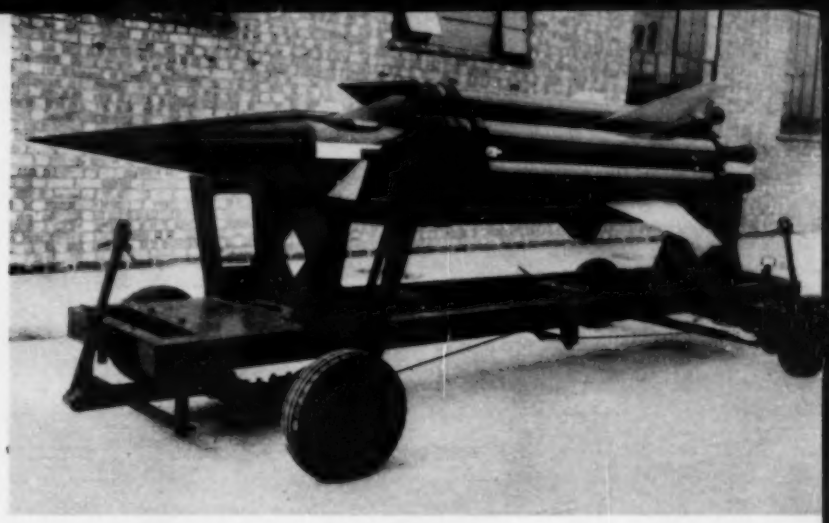
Slingsby T.34 Sky Over the past three years the impressive reputation of the Sky has steadily developed. Flown by Philip Wills into first and second places in the 1952 and 1954 World Championships, and by Geoffrey Stephenson into top place at last year's British Nationals, this sailplane has been chosen by pilots of many countries. Seven Skys were entered for this year's world contests at Great Hucklow, more than any other type. Span 59ft, aspect ratio 18.65:1, length 25ft 4in, all-up weight 800 lb.

Eon Olympia 4 As part of the company's research and development programme, Elliotts of Newbury have recently designed and constructed a new laminar-flow wing, which has been fitted to a standard Eon Olympia fuselage. This sailplane, a "one-off" job, was flown by Geoffrey Stephenson in this year's World Championships. Results appear to be good, laminar flow over 55 per cent of the wing surface having been obtained and, as the next step in research prior to Elliotts' next design, a similar investigation into the improvement of flow over the tail unit is being made. Deliveries of the original Eon Olympia, high-performance regular with most British clubs, continue. Span 49ft 2in, aspect ratio 15:1, length 23ft 1in, all-up weight 710 lb.

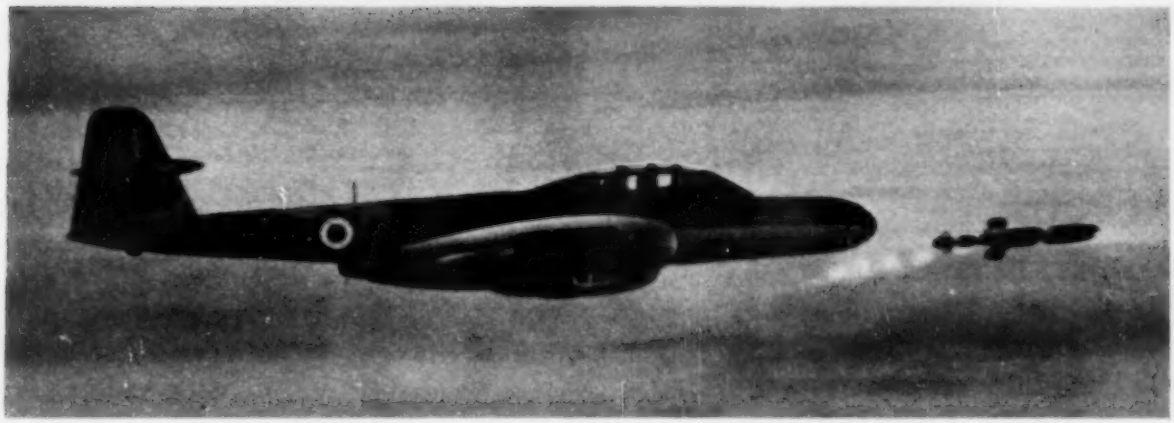
Kendall K.1 Developed from Hugh Kendall's winning entry in the B.G.A.'s 1947 design competition for a high-performance two-seater, the K.1 was intended to have wings of Durestos asbestos-thermosetting plastic material. Although work on these wings was carried out by F. G. Miles, Ltd., at Redhill, the project was not completed and laminar-flow wings of wooden construction were made for the K.1 by Elliotts of Newbury. Test flying of the sailplane by its designer began earlier this year but development to contest-flying standard had not been completed in time for Phillip Wills to fly it in the World contests, as had been hoped. An option on the manufacturing rights for this sailplane is now held by Elliotts. Notable design features are the vee-tail, the excellent visibility from the cockpit and the full-span ailerons. Span 60ft 6in, aspect ratio 18.4:1, length 20ft, all-up weight 1,050 lb.

BRITISH AIRCRAFT 1954

Missiles and Targets



Armstrong Whitworth guided missile test vehicle.



Guided missile being launched from Meteor N.F.11.

Missile test vehicle at the Aberporth range.

ALTHOUGH, generally speaking, reference to specific types and makes of British guided missiles is prohibited, it was made known late last year that the photograph heading this page depicts "an early Armstrong Whitworth guided missile test vehicle." The auxiliary booster rockets which thrust the main vehicle to its full supersonic speed are grouped round the central body.

At the instant of being launched from a Meteor N.F.11 night fighter is an early-pattern of air-to-air guided missile of the general class which is likely first to appear in R.A.F. service on the Gloster Javelin.

Then, roaring out to sea from the Aberporth range goes another type of British missile test vehicle.

The greatest of the Commonwealth missile-testing ranges is, of course, at Woomera, in Australia. It was explained in our Commonwealth Aircraft Industries issue last week that the initial stage in the development of a guided weapon is the preparation of a series of test vehicles, which are used to perfect the aerodynamics, guidance, structure, power unit and launching procedure. Test vehicles of both British and Australian design and manufacture have been fired at Woomera. Personnel and a great variety of intricate equipment are sent to the range from many parts of Britain, from Australian sources and from British factories in Australia. The latter are all located in the Salisbury region, and the firms involved include Armstrong Whitworth, Bristol, E.M.I., English Electric, Fairey (of Australia), Vickers-Armstrongs and Sperry.

It has been reported in America that "a new

Auster B.3.

Air Service Training C.4.

Missiles and Targets

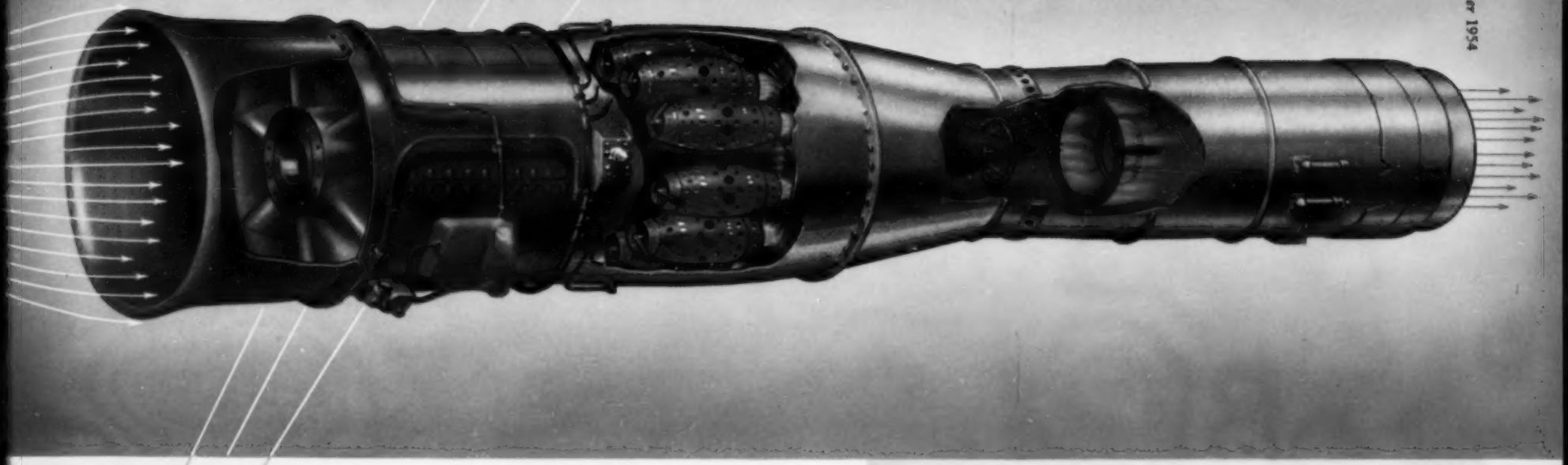
type of bomb for high-speed, high-altitude bombers" has been under development at Woomera, and that dropping trials have been made from 40,000ft. It is not unreasonable to link this report with the assertion by a former C-in-C. Bomber Command, that "we have got to get away from this free-falling-bomb business and put as much effort as we can into the guided bomb as quickly as possible."

A most creditable design of pilotless aircraft, suitable not only for the testing of guidance systems but as a remote-controlled target, is Australia's D.A.P. Jindivik, powered by an Armstrong Siddeley Viper turbojet. There is no undercarriage and no cockpit, take-off being effected from a special trolley and the landing being made on a retractable skid. Control is effected by a radio receiver, interpreter and automatic pilot, with a transponder to increase the range at which the aircraft can be tracked. British automatic stabilizing equipment is fitted. The wing has no sweep, but the thickness/chord ratio is no more than 10 per cent in the Jindivik Mk 1 and has been reduced to 6 per cent in the Mk 2, which is, in consequence, almost transonic. Jindiviks are in production for the British and Australian Governments.

Simpler types of pilotless target aircraft, of British manufacture, are depicted on this page. First is the **Auster B.3**, designed to afford practice with Bren guns attached to 40 mm Bofors. It is powered with a 276 c.c. A.B.C. air-cooled flat-twin engine developing about 6 h.p. The fuselage is of vee-section and houses the fuel tank, a parachute and radio-control unit. Should the target still be flying on the completion of a shoot, or if its limit of duration is being approached, it may be recovered by means of the parachute, which deploys automatically when the ground operator presses a button on the control box. The shapely target glider next seen, on the ground, is the **Air Service Training C.4**, which is towed behind a tug aircraft at high subsonic speeds. The small fuselage provides an aiming datum for the attacking aircraft and houses a radar transponder, if required, and a firing-error indicator unit. The third machine is another towed target, manufactured by **Brooklands Aviation, Ltd.**, and to be introduced at Farnborough this year. Then comes the **M.L. radio-controlled target**, powered by a modified Vincent Picador engine and weighing 42 lb. This tiny machine attains sea level speed of 230 kt and is still good for 190 kt at 10,000ft. Launching is effected from an "easel" with the aid of rockets. In the event of radio contact being lost, or the engine failing, or if it is desired to land the aircraft, a parachute, flotation bag (seen inflated in the picture) and shock-absorber bag are automatically brought into play and the engine, if still running, is cut. The twin-fuselage towed target is the **R.F.D. Mk 1**, with a span of 26ft. It is intended for both ground-to-air and air-to-air practice.

(Above) Brooklands Aviation towed target; (below, left) M.L. Aviation radio-controlled target; (below, right) R.F.D. Mk 1 towed target.

Specialists in Gas Turbine Combustion Components



The illustration shows a typical Aircraft Gas Turbine Engine. The parts shown in red and grey, comprising:

Flame Tubes, Combustion Chamber Outer Casing, Exhaust Unit, Reheat Jet Pipe Assembly

are manufactured at our Works at Southampton.

We also manufacture the following major units:

Front Nozzle Box Panels.
Discharge Nozzles.
Cooling Air Manifolds.
Annular Combustion Chambers (complete)
Combustion Chamber Heat Shrouds
Stator Conical Supports
Outlet Branch Extension Units
Bearing Housing Units
Bearing Cover Units
Fire Wall Units
Oil Tank Units
Jet Pipe Assemblies

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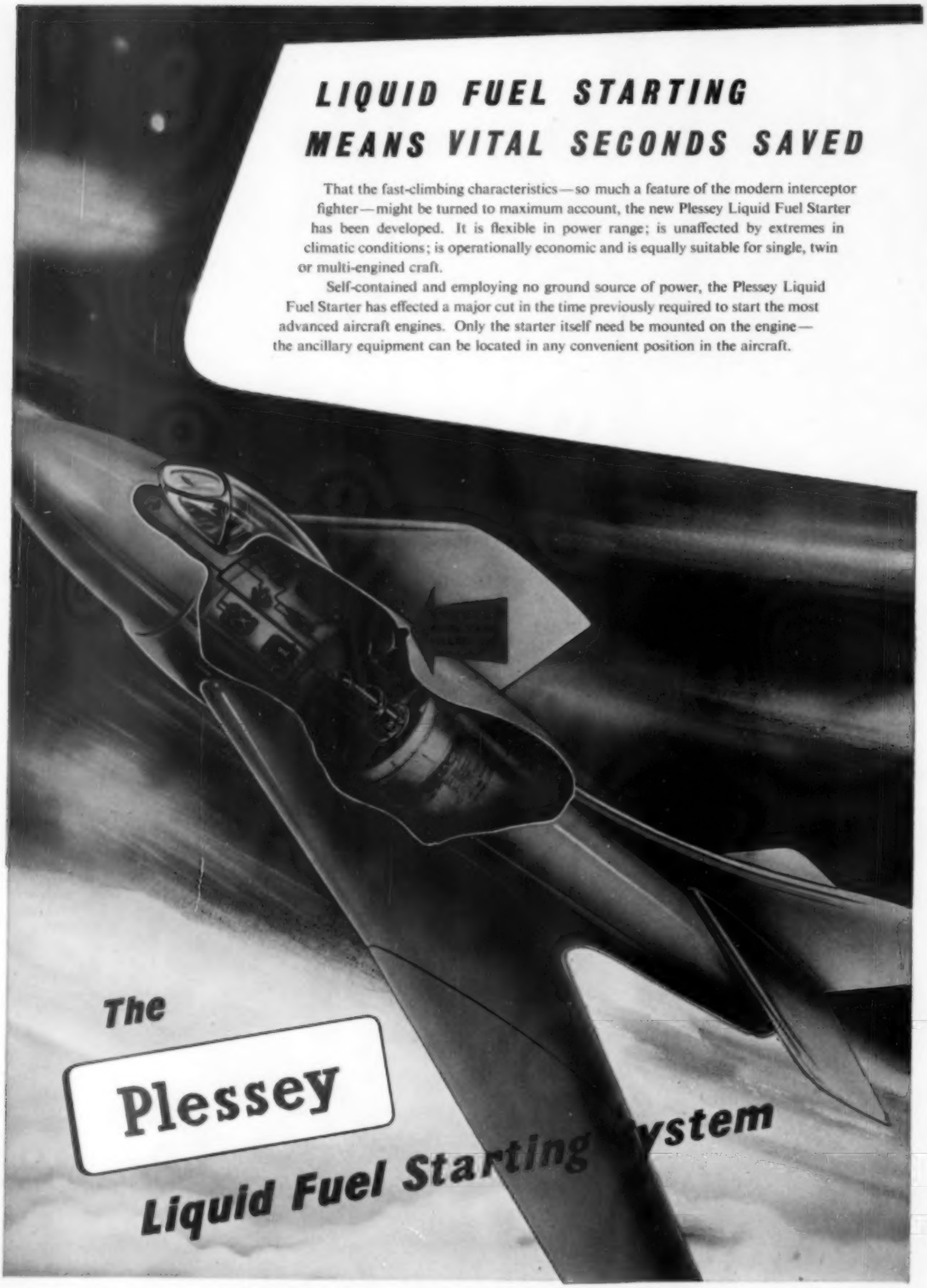

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That the fast-climbing characteristics—so much a feature of the modern interceptor fighter—might be turned to maximum account, the new Plessey Liquid Fuel Starter has been developed. It is flexible in power range; is unaffected by extremes in climatic conditions; is operationally economic and is equally suitable for single, twin or multi-engined craft.

Self-contained and employing no ground source of power, the Plessey Liquid Fuel Starter has effected a major cut in the time previously required to start the most advanced aircraft engines. Only the starter itself need be mounted on the engine—the ancillary equipment can be located in any convenient position in the aircraft.

The **Plessey** Liquid Fuel Starting System

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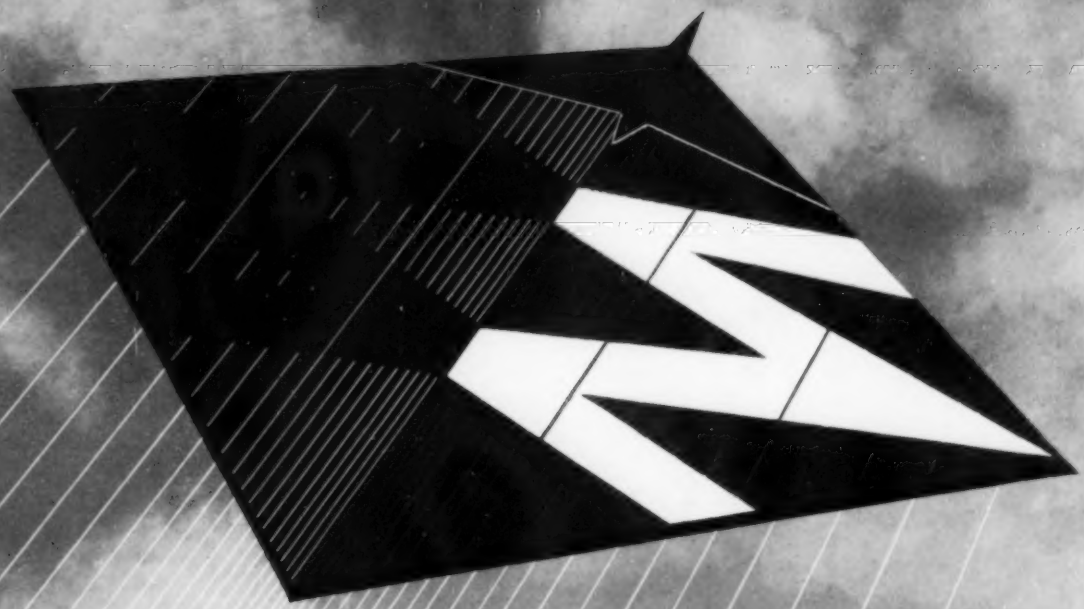

. . . *from time to time*

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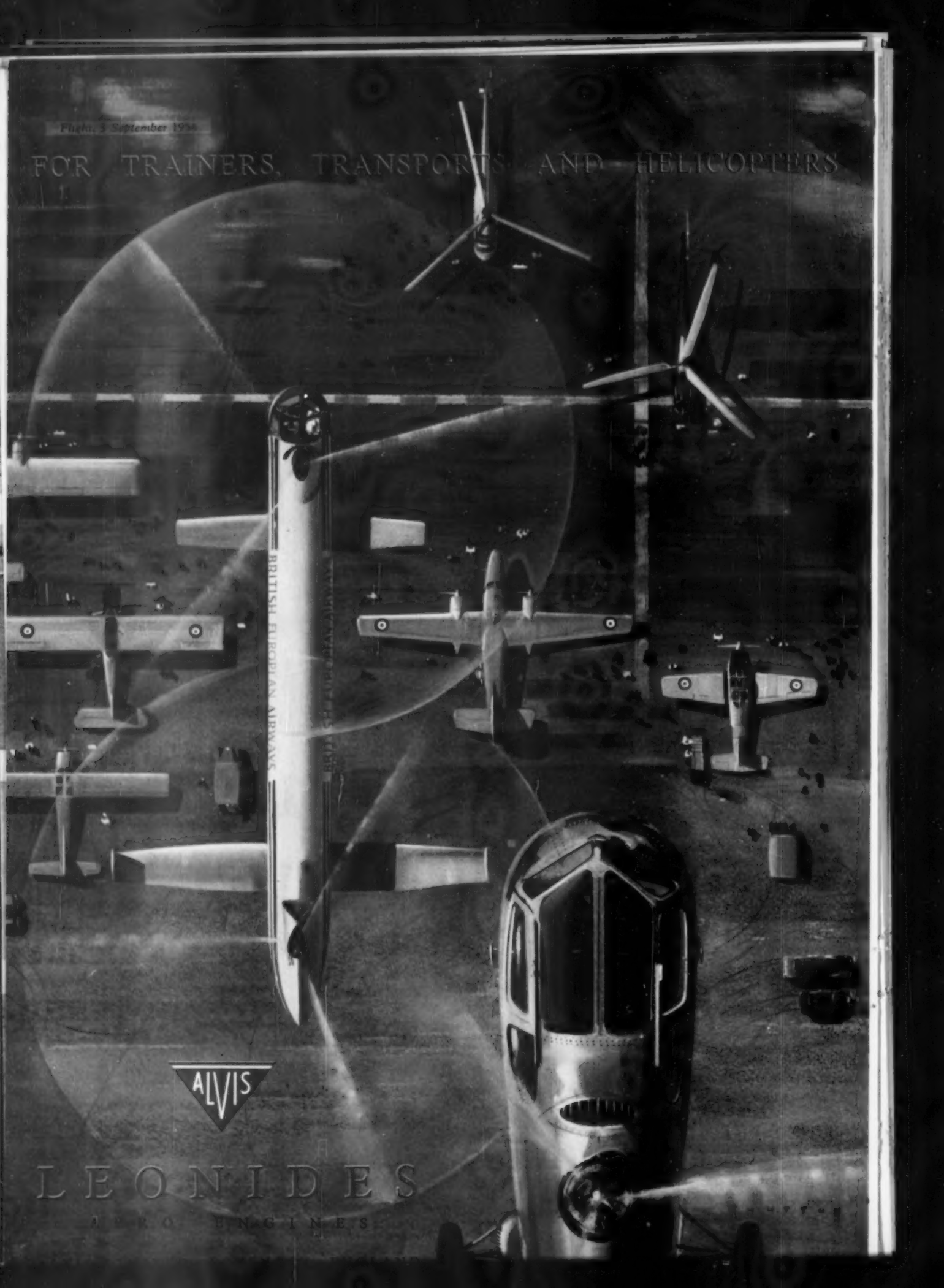


BRITISH EUROPEAN AIRWAYS

ALVIS

LEONIDES

AERO ENGINES

BRITISH MILITARY AIRCRAFT, 1954

(INCLUDING RESEARCH TYPES)

Maker and Type	Main Duties	Span ft in	Length ft in	Power Unit(s) No.	Power Unit(s) Type	Power Unit(s) Power (see note 1)	Normal a.u.w. lb	Wing Loading lb/sq ft	Armament (see note 2) Guns No. Cal. mm	Armament (see note 2) Bombs No. Wt. lb	Armament (see note 2) R.P.s No. Wt. lb	Max. speed m.p.h.	Max. speed ft	Climb to ft	Climb min	Typical Range miles
Armstrong Whitworth:																
Meteor N.F.14 ...	F. ...	43 0	49 11½	2	Derwent ...	n.r.	n.r.	n.r.	4 20	nil	nil	n.r.	n.r.	n.r.	n.r.	n.r.
Auster:																
Auster A.O.P.6 ...	O.C.	36 0	23 2	1	Gipsy Major 7 or 8	145	2,210	11.9	nil	nil	nil	123	1,000	i.r.c. =	810 ft/min	345
Auster T.7	T.O.C.	36 0	23 2	1	Gipsy Major 7 or 8	145	2,210	11.9	nil	nil	nil	123	1,000	440 ft/min	at 5,000 ft	290
Auster A.O.P.9 ...	O.C.	36 5	23 8½	1	Bombardier 203	180	2,050	10.4	nil	nil	nil	127	—	5,000	6.4	242
Avro:																
Vulcan B.1	B. ...	99 0	97 1	4	Olympus ...	n.r.	n.r.	n.r.	nil	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Shackleton M.R.2 ...	R.A.-S.	120 0	87 4	4	Griffon	n.r.	n.r.	n.r.	4 20	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Shackleton M.R.3 ...	R.A.-S.	—	—	4	Griffon	n.r.	n.r.	n.r.	4 20	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
707C	T. ...	34 2	42 9	1	Derwent ...	3,500	n.r.	n.r.	nil	nil	nil	n.r.	n.r.	n.r.	n.r.	n.r.
Blackburn and General Aircraft:																
Beverley C.1	Tr. ...	162 0	99 2	4	Centaurus ...	n.r.	n.r.	n.r.	nil	nil	nil	n.r.	n.r.	n.r.	n.r.	n.r.
Boulton Paul:																
Balliol T.2	T. ...	39 4	35 1½	1	Merlin 35 ...	1,280	8,410	33.64	1 7.7	8 25	4 60	288	9,000	10,000	6	670
Sea Balliol T.21 ...	T. ...	39 4	35 1½	1	Merlin 35 ...	1,280	8,704	34.81	1 7.7	8 25	4 60	285	9,000	10,000	6	655
P.111A	R'ch.	33 6	26 1	1	Nene	n.r.	n.r.	n.r.	nil	nil	nil	n.r.	n.r.	n.r.	n.r.	n.r.
de Havilland:																
D.H.110	F. ...	51 0	52 0	2	Avon	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Venom F.B.4	F.B. ...	41 9	33 0	1	Ghost	n.r.	n.r.	n.r.	4 20	2 1,000	8 60	n.r.	n.r.	n.r.	n.r.	n.r.
Venom N.F.3	F. ...	41 9	35 3	1	Ghost	n.r.	n.r.	n.r.	4 20	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Sea Venom F.A.W.21 ...	F. ...	41 9	35 3	1	Ghost	n.r.	n.r.	n.r.	4 20	n.r.	8 60	n.r.	n.r.	n.r.	n.r.	n.r.
Vampire Trainer ...	T. ...	38 0	34 6	1	Goblin 35 ...	3,500	11,680	44.7	4 20	opt.	8 25	538	s.l.	30,000	14	789
Chipmunk T.20 ...	T. ...	34 4	25 5	1	Gipsy Major 8 ...	145	2,014	11.57	nil	nil	nil	138	s.l.	5,000	7	280
English Electric:																
Canberra B.2, P.R.3, T.4, B.5 and B.6 ...	B.R.T.	64 0	65 6	2	Avon	n.r.	n.r.	n.r.	nil	n.r.	nil	n.r.	n.r.	n.r.	n.r.	n.r.
Canberra P.R.7 ...	R. ...	64 0	66 8	2	Avon	n.r.	n.r.	n.r.	nil	n.r.	nil	n.r.	n.r.	n.r.	n.r.	n.r.
Canberra B.8 ...	B.I. ...	64 0	65 6	2	Avon	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
P.1	F. ...	n.r.	n.r.	2	Sapphire ...	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Fairey:																
Firefly A.S.7 and T.7 ...	A.-S.T.	44 6	38 3	1	Griffon 59 ...	1,960	13,370	41	nil	2 1,000	opt.	300	10,750	1,500	1	860
Firefly Mk 8	Tar.	43 3	38 3	1	Griffon 59 ...	n.r.	15,800	n.r.	nil	nil	nil	n.r.	n.r.	n.r.	n.r.	n.r.
Gannet A.S.1 and T.2	A-S.T.	54 4	43 0	1	Double Mamba	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
F.D.1	R'ch.	19 6½	26 3	1	Derwent ...	n.r.	n.r.	n.r.	nil	nil	nil	n.r.	n.r.	n.r.	n.r.	n.r.
Folland:																
Midge	F. ...	20 8	28 9	1	Viper 101 ...	1,640	4,500 app.	40 app.	2 30	n.r.	n.r.	over 600	—	n.r.	n.r.	n.r.
Gnat	F.B. ...	20 8	28 9	1	Orpheus ...	n.r.	n.r.	n.r.	2 30	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Gloster:																
Javelin F.A.W.1 ...	F. ...	52 0	57 0	2	Sapphire ...	n.r.	n.r.	n.r.	n.r.	nil	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Meteor P.V. 7/8 ...	T. ...	41 2	44 7	2	Derwent 8 ...	7,000	14,426	41.2	nil	nil	nil	580	s.l.	7,600	1	525
Meteor T.7	T. ...	37 2	43 6	2	Derwent 8 ...	7,000	14,000	40	nil	nil	nil	580	s.l.	30,000	5.6	605
Meteor F.8	F.B. ...	37 2	44 7	2	Derwent 8 ...	7,000	15,700	44	4 20	2 1,000	16 95	595	10,000	40,000	11.4	690
Meteor F.R.9	F.R. ...	37 2	43 6	2	Derwent 8 ...	7,000	15,660	44	4 20	nil	nil	595	10,000	40,000	11.4	690
Meteor P.R.10 ...	R. ...	43 0	44 3	2	Derwent 8 ...	7,000	15,330	40	nil	nil	nil	575	10,000	40,000	10	1,400
Handley Page:																
Victor B.1	B. ...	110 0	114 11	4	Sapphire ...	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Hastings C.2 ...	Tr. ...	113 0	82 1	4	Hercules 106 ...	6,700	80,000	56.8	nil	nil	nil	348	22,200	10,000	11	2,000
Marathon 1A, Series 103	T. ...	65 0	52 1½	4	Gipsy Queen 70-4	1,360	17,535	35.25	nil	nil	nil	—	—	10,000	14	1,290
Hawker:																
Hunter F.1	F. ...	33 8	45 10½	1	Avon	n.r.	n.r.	n.r.	4 30	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Hunter F.2	F. ...	33 8	45 10½	1	Sapphire ...	n.r.	n.r.	n.r.	4 30	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Sea Hawk F.B.3 ...	F.B. ...	39 0	40 0	1	Nene	n.r.	n.r.	n.r.	4 20	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Hunting Percival:																
Provost T.1	T. ...	35 2	28 8	1	Leonides 25 ...	550	4,300	20.1	2 7.7	8 25	6 60	200	2,300	10,000	7	630
Jet Provost T.1 ...	T. ...	35 5	31 11	1	Viper 5	1,750	5,950	27.2	nil	nil	nil	323	20,000	30,000	24.4	—
Pembroke C.1 ...	Tr.T.	64 6	46 0	2	Leonides ...	1,100	13,000	32	nil	nil	nil	220	2,000	10,000	10.5	1,030
Sea Prince T.1 ...	T. ...	56 0	46 3½	2	Leonides 25 ...	1,100	11,850	32.5	nil	nil	nil	223	2,000	5,000	5.7	530
Short:																
S.B.5 (see note 3) ...	R'ch.	30 6	45 9	1	Derwent ...	n.r.	n.r.	n.r.	nil	nil	nil	n.r.	n.r.	n.r.	n.r.	n.r.
Sherpa	R'ch.	38 0	31 10½	2	Palas	700	3,125	—	nil	nil	nil	—	—	—	—	—
Seamew A.S.1 ...	A-S.	55 0	41 0	1	Mamba	n.r.	n.r.	n.r.	nil	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Vickers-Armstrongs:																
Valiant B.1	B. ...	114 4	108 3	4	Avon	n.r.	n.r.	n.r.	nil	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Valiant B.2	B. ...	114 4	114 0	4	Avon RA. 14 ...	n.r.	n.r.	n.r.	nil	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Type 1000	Tr. ...	140 0	146 0	4	Conway	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Varsity T.1	T. ...	95 6	67 6	2	Hercules 264 ...	3,900	37,500	38.5	nil	24 25	nil	290	5,000	10,000	7.5	1,500
Valetta C.1	Tr. ...	89 5	63 2	2	Hercules 230 ...	3,950	36,500	41.3	nil	nil	nil	291	10,000	max. r.o.c. =	1,500 ft/min	1,460
Valetta T.3	T. ...	89 5	65 3	2	Hercules 230 ...	3,950	36,500	41.3	nil	nil	nil	291	10,000	as above		1,410
Vickers-Supermarine:																
Swift F.4	F. ...	32 4	41 6	1	Avon	n.r.	n.r.	n.r.	4 30	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Swift F.R.5	F.R. ...	32 4	43 0	1	Avon	n.r.	n.r.	n.r.	2 30	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Type 525	F. ...	n.r.	n.r.	2	Avon	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.	n.r.
Attacker F.B.2 ...	F.B. ...	36 11	37 6	1	Nene 102 ...	5,000	11,750	52	4 20	2 1,000	8 60	583	s.l.	30,000	7.1	1,190
Westland:																
Wyvern S.4	Strike	44 0	41 10	1	Python	n.r.	n.r.	n.r.	4 20	2 1,000	16 65	n.r.	n.r.	n.r.	n.r.	n.r.

Abbreviations: A-S. = anti-submarine; a.u.w. = all-up weight; B. = bomber; C. = communications; F. = fighter; I. = intruder; i.r.c. = initial rate of climb (ft/min); n.r. = not released; O. = observation; R. = reconnaissance; R'ch. = research; r.o.c. = rate of climb; R. P. = rocket projectile; s.l. = sea level; Tar. = target; T. = training; Tr. = transport. **Notes:** (1) For piston engines, power (in h.p.) is for take-off; for turbojets, thrust (in lb) is static. (2) Bomb and R.P. loads are generally alternatives. (3) Dimensions are for 60 deg sweepback.

BRITISH CIVIL AIRCRAFT, 1954

(INCLUDING TYPES NOT YET UNDER CONSTRUCTION)

Maker and Type	Span ft in	Length ft in	Power Unit(s) No.	Type	Power (see note 1)	Normal a.u.w. lb	Wing Loading lb/sq ft	Max. Disposable Load lb	Volumetric Payload Capacity cu ft	No. of Pass.	Cabin Air (see note 2)	Max. Still-Air Range miles	Typical Performance: Distance miles (see note 3)	Height ft	Speed m.p.h.	Payload lb	Representative Field Length (I.S.A.) yd (see note 4)
Auster:																	
Aiglet Trainer ...	32 0	23 2	1	Gipsy Major 1	120	1,850	11.3	877	—	1/2	—	—	275	1,000	109	—	330
Autocar	32 0	23 2	1	Cirrus Major 3	140	2,450	13.3	1,091	62	3	—	—	520	1,000	110	650	380
Aviation Traders:																	
Accountant ...	77 6	57 6	2	Dart RDa 6	3,100	24,000	40	10,350	1,625	22/36	P.	—	690	25,000	270	5,900	930(c)
Avro:																	
Atlantic	121 0	145 0	4	Olympus (?)	—	200,000	—	45,000	7,820	94/131	P.	6,000+	4,000	45,000	600	22,000	2,000(c)
Blackburn:																	
Universal Freighter ...	162 0	99 2	4	Centaurus 173	11,400	135,000	46.4	55,766	7,100	130	—	3,680	200	8,000	180	46,300	1,180(c)
Bristol:																	
Type 170 Mk 31E	108 0	68 4	2	Hercules 734	3,960	44,000	30	14,617	2,360	44	—	1,730	850	5,000	166	10,000	825
Type 170 Mk 32 ...	108 0	73 6	2	Hercules 734	3,960	44,000	30	12,200	3,000	(see note 5)	—	1,730	850	5,000	166	8,352	825
Britannia 100 ...	140 0	114 0	4	Proteus 705	15,120	140,000	68.2	68,000	—	83	P.	6,300	4,100	29,400	340	25,000	1,850(c)
Britannia 300 ...	142 3½	124 3	4	Proteus 755	16,600	155,000	75.5	75,000	—	101	P.	(see note 6)	3,800	30,200	350	30,000	1,800(c)
de Havilland:																	
Airspeed Ambassador ...	115 0	82 0	2	Centaurus 661	5,200	52,500	43.7	16,276	2,540	47	P.	1,660	1,220	20,000	242	7,600	1,570(c)
Comet 1	115 0	93 0	4	Ghost 50 ...	20,000	107,000	53	56,000	2,478	36	P.	—	1,500	40,000	480	12,500	2,400(c)
Comet 2	115 0	96 0	4	Avon 503 ...	28,000	120,000	59.5	64,000	—	44	P.	—	2,200	40,000	500	13,500	2,110(c)
Comet 3	115 0	111 6	4	Avon 521 ...	40,000	150,000	—	—	—	58/76	P.	—	2,690	40,000	500	20,200	—
Dove 5	57 0	39 3	2	Gipsy Queen 70, Mk 2	760	8,800	26.3	2,420	392	11	—	1,153	490	8,000	179	1,672	810
Heron 2	71 6	48 6	4	Gipsy Queen 30, Mk 2	1,000	13,000	26	—	586	11/17	—	1,375 (see note 7)	690	8,000	183	2,926	980(c)
Handley Page:																	
Hermes	113 0	96 10	4	Hercules 763	8,400	86,000	61.1	30,650	3,754	40/60	P.	3,430	1,345 (s)	10,000	268	17,000	1,700(c)
Marathon ...	65 0	52 1½	4	Gipsy Queen 70, Mk 4	1,360	18,250	36.14	5,972	1,010	18/20	—	1,020	940	5,000	167	3,740	920
Herald	95 0	70 3	4	Leonides Major	3,480	34,000	38.55	—	—	44	P.	2,175	500	10,000	194	10,165	666(c)
H.P.97	—	—	4														
H.P.97	—	—	4	Sapphire (?)	—	—	—	—	—	150	—	—	2,210	45,000	500	33,000	—
Hunting Percival:																	
Prince III	56 0	42 10	2	Leonides 24	1,100	11,000	30.2	3,190	620	8/12	—	1,107	650	5,000	151	1,660	800
New Prince V ...	64 6	46 0	2	Leonides 503/4	1,080 /1,120	12,500	31	4,000	—	12	—	1,160	650	8,000	150	2,090	1,265(c)
P.87 development	92 0	—	2	Oryx ...	1,500	25,000	—	—	—	30	P.	—	—	—	265	—	900
Saunders-Roe:																	
Princess	219 6	148 0	10	Proteus ...	35,000	320,000	65	137,000	13,500	105	P.	—	—	—	—	—	—
Scottish Aviation:																	
Pioneer 2	49 9	34 6	1	Leonides 501/4	520	5,400	13.8	1,300	80	4	—	425	400	5,000	120	850	230
Twin Pioneer ...	76 6	45 1	2	Leonides 502/1	1,100	13,500	20.5	4,425	—	14/16	—	620	565 (s)	5,000	139	3,008	342
Vickers-Armstrongs:																	
Viscount 700D ...	93 8½	81 2	4	Dart 510	6,760	60,000	60.75	25,425	2,474	40/59	P.	(see note 8)	1,450	20,000	320	12,800	1,730(c)
Viscount 800 ...	93 8½	85 0	4	Dart RDa5	6,760	—	—	—	—	44/70	P.	—	—	—	—	—	—
V.C.7	140 0	146 0	4	Conway ...	—	200,000	—	—	—	120	P.	—	—	—	—	—	—

Notes: (1) For piston engines, power (in h.p.) is for take-off; for turboprops, an equivalent brake horsepower is given; for turbojets, thrust (in lb) is static. (2) P = pressurized. (3) Where possible, a typical stage-length with allowances is given; (s) indicates still-air range. (4) Distance accompanied by (c) includes allowance for engine-cut. (5) 20 passengers and three cars. (6) The maximum range of the Britannia 100 with full tanks and 15,000 lb payload is 5,270 miles; corresponding figures for the Britannia 300 are 5,180 miles with 18,000 lb (standard tankage) and 6,100 miles with 16,000 lb (L.R. version). (7) Stage-length with five passengers and baggage. (8) 2,410 miles with slipper tanks; 2,190 miles with standard tankage.

HELICOPTERS

Maker and Type	Main Rotors	Rotor Diam. ft in	Fuselage Length ft in	Power Unit(s) No.	Type	Power h.p.	a.u.w. lb	Disc Loading lb/sq ft	Disposable Load lb	No. of Pass.	Typical Performance: Range miles	Height ft	Speed m.p.h.	Payload lb
Bristol:														
Type 171 Mk 4 (Sycamore) ...	1	48 6.7	42 0	1	Leonides ... ... Le.23 H.M.V.	545	5,300	2.86	1,380	3/4	270	s.l.	91	706
Type 173 Mk 1	2	48 6.7	55 1.7	2	Leonides ... ... Le.23 H.M.V. Mk 73	1,090	10,600	2.86	2,800	10	100	2,500	85	1,200
Type 173 Mk 3	2	48 6.7	54 1½	2	Leonides Major ...	1,740	13,500	3.64	3,760	14	See note 1			
Hunting Percival:														
P.74	1	—	—	1	Napier Oryx ...	750	7,750	—	—	8	—	—	—	—
Saunders-Roe:														
Skeeter	1	32 0	28 5	1	Bombardier ...	180	2,100	2.6	624	1	See note 2			
Westland-Sikorsky:														
S-51 (Dragonfly)	1	49 0	41 1½	1	Leonides 521/1 ...	520	5,700	3.15	1,073	3	200	up to 4,000	80	653
S-55 (Whirlwind)	1	58 0	41 8½	1	Wasp R-1340 ...	600	7,500	3.4	2,240	10	200	up to 6,200	90	1,598

Notes: (1) Max. speed is 153 m.p.h. approx.; max. cruising speed, 138 m.p.h. approx.; 16 passengers, with baggage, can be carried for a distance of 230 miles. (2) Max speed is 115 m.p.h. and endurance 3 hr at 86 m.p.h.

BRITISH POWER UNITS—1954

COMPETITION was never keener throughout the world nor technical resources more extended; even in countries with economies less delicately balanced than our own, there is now very little room for duplication of effort. It is a sign of the times that each of the four wholly new British aero engines announced since the appearance of our 1953 "Farnborough Special" fills a definite need which cannot be met by any other engine.

The mighty de Havilland Gyron promises to be one of the best products that has ever been offered in the realm of propulsion for fast flight, and various types of large D.H. axial turbojets should be with us, subsonically and supersonically, for many years. The Bristol Orpheus, while it does not aspire to such great power, delivers its "medium power" (what would have been a very impressive thrust figure ten years ago) with great efficiency, and without exceeding the space envelope needed by the engine and gearbox of a fair-sized car.

The Rolls-Royce establishment at Derby have pulled a very remarkable rabbit out of their hat, and our only regret is that it should have a river name which must be read (in the South at least) before it is heard. The Soar axial turbojet is, in spite of its tiny compass and simple exterior, the outcome of a very great research programme aimed at obtaining the greatest possible power from a given size of engine—an aim which has been amply achieved.

Finally, the Napier company have been allowed to reveal a little of their work in the field of helicopter propulsion, in the irregular—yet eminently logical—shape of the Oryx turbo gas generator. This unusual power plant, embodying one of the smallest axial compressors running anywhere, has already reached an advanced stage of development, and it has very many applications.

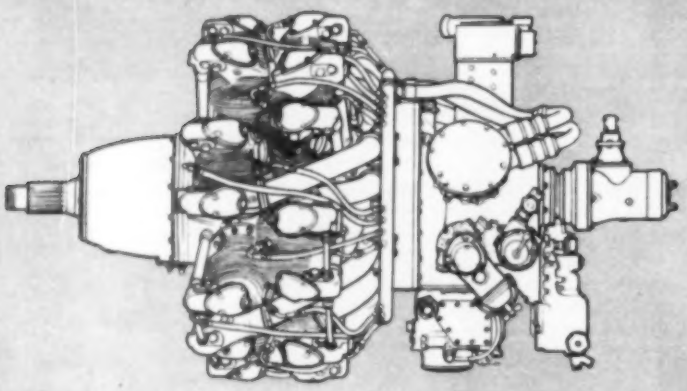
Unfortunately, little that is new may be told of the immense work that is going on in the sphere of rocketry. Many, or most, of the British rockets should not be considered under the title of a power plant at all, for they are being prepared for take-off assistance or for guided weapons. Yet Armstrong Siddeley and de Havilland have both made notable contributions to this field, and later S.B.A.C. shows will no doubt provide an opportunity of exhibiting some of their work.

The smaller firms in the engine industry are also promising to maintain their position. Alvis are going ahead steadily with the Leonides Major, which appears this year in a form suitable for rotary-wing aircraft. Blackburn and General Aircraft, while continuing forward development of the lively Bombardier, have also carried out a certain amount of redesign on the Turboméca engines for which they hold a manufacturing licence. Production of these is now beginning. Other names are also coming into the picture; they include Fairey and Saunders-Roe, both of whom are developing helicopter tip-drive systems employing pressure-jets and pulse-jets, respectively.

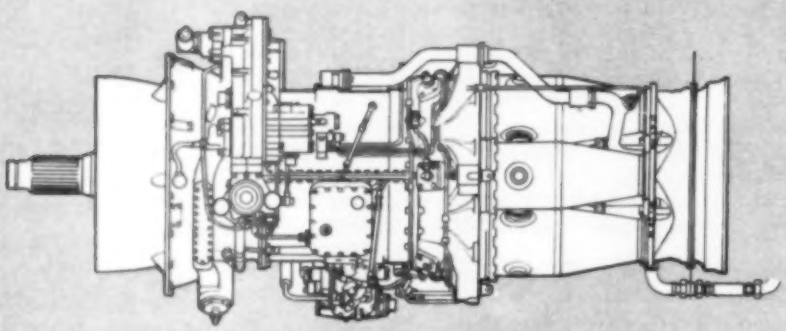
Altogether, the outlook is a very bright one, and it augurs well for our aeronautical future. No one dare forget that an engine takes at least as long to develop as does an aircraft, and it is essential that the right engine should be ready for installation in the prototype of each new aircraft at the earliest opportunity. As far as can be judged from what may be published, British aircraft manufacturers can now safely plan a great variety of competitive aircraft without wondering when and where their power units will be available.

Alvis Leonides 534/1 (helicopter) nine-cylinder, air-cooled poppet-valve radial, with crankshaft vertical, fan cooling and no reduction gearbox. Cylinder bore and stroke, 4.9 by 4.41in; swept volume, 718.6cu in (11.78 litres); overall diameter, 41.5in; overall height, 32.83in; dry weight, 642 lb; maximum power, 540 b.h.p. at 3,200 r.p.m. at 7 lb boost at 4,000ft.

Alvis Leonides Major 1-1 (fixed-wing) fourteen-cylinder, two-row radial. Cylinder size as Leonides, giving swept volume of 1,117.8 cu in (18.28 litres); overall diameter, 38.9in; length, 70.9in; dry weight, 1,150 lb; maximum power, 870 b.h.p. at 3,000 r.p.m. at 8 lb boost at sea level.

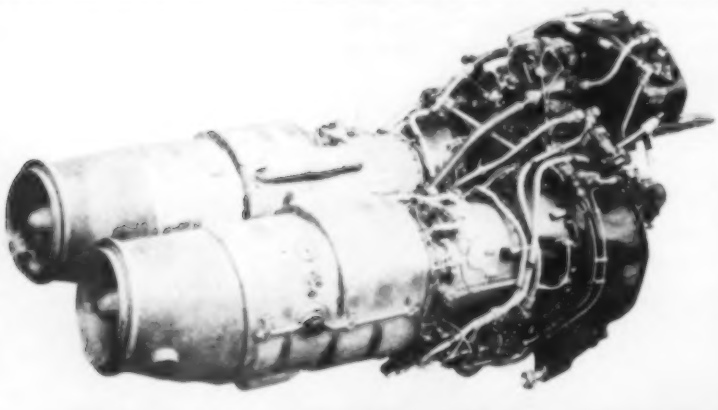


Alvis Leonides and Leonides Major During the past year, the only British aero engine in the range 380/1,400 h.p. has been the Alvis Leonides. It continues to be greatly in demand and is currently the only British helicopter engine in service. The basic Leonides is a light and compact nine-cylinder poppet-valve radial, with a Hobson fuel-injection automatic carburettor providing for single-lever engine control. For helicopters, a whole family of vertical-crankshaft Leonides has been developed (an example is illustrated) which are made in the form of a complete power unit with a cooling fan, clutch and air shroud. No reduction gear is fitted to these engines, the gearbox being mounted on the airframe. The Leonides Major consists, in effect, of fourteen standard Leonides cylinders arranged around a common crankcase in two rows of seven. All the experience gained with the Leonides has been built-into the new engine, and it is expected that it will be selected for several types of fixed-wing aircraft and helicopters. For the latter, a special range of engines is being developed, equipped to run with the crankshaft at any angle between horizontal and vertical; the first such engine to be publicly displayed is to be at the forthcoming S.B.A.C. show. The reduction in diameter due to the banks of seven cylinders instead of nine results in a very efficient cowling in fixed-wing machines, and an advantage to helicopters is that the Major can be mounted in a fuselage without taking up the entire available width. This permits a communication walkway to be provided around the engine. Prototype Majors have been running for just over a year, and flight testing is to take place in the Marathon 2.



Armstrong Siddeley Mamba ASM.3 single-shaft turboprop. Ten-stage axial compressor, six combustion chambers and two-stage turbine. Mass flow, 18.5 lb/sec with pressure ratio 5.35:1. Overall diameter, 29in; overall length, 87.3in; dry weight, 780 lb; maximum power, 1,320 s.h.p. + 405 lb thrust (1,475 e.s.h.p.) at sea level or 15,000 r.p.m. with specific fuel consumption 0.8 lb/hr/e.s.h.p.

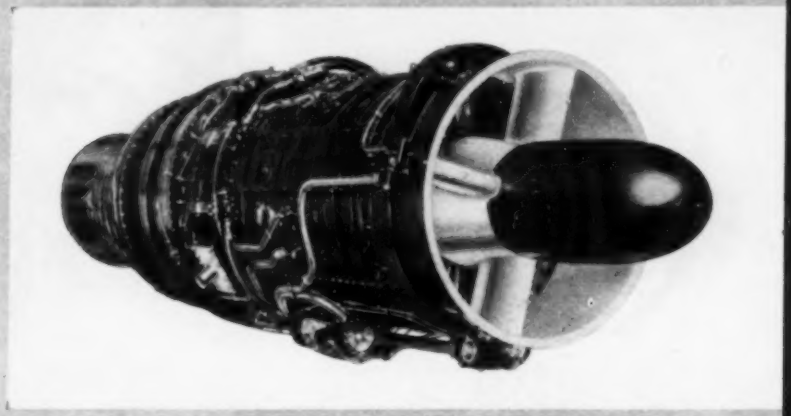
Armstrong Siddeley Double Mamba ASMD.3. Power sections identical with Mamba ASM.5, with annular combustion chambers. Overall width, 52.8in; height, 48.8in; length, 102.25in; dry weight, 2,170 lb; maximum power, 2,960 e.s.h.p. at sea level.



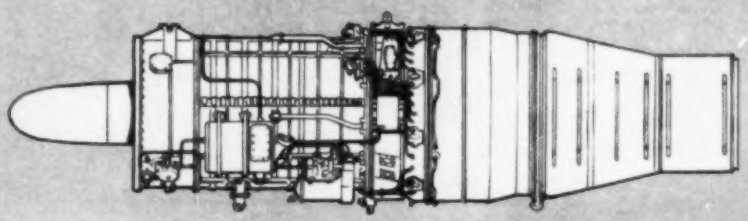
Armstrong Siddeley Mamba The Mamba was the first engine designed as a turboprop ever to fly. In the course of its development, it has become neater, more compact, more efficient and easier to maintain, and its power has also been almost doubled from the design rating of 1,000 h.p. This engine introduced a vaporizing combustion system, in which the fuel is vaporized in "walking-stick" burners at comparatively low pressure, in a manner similar to that employed on domestic blow-lamps. The most important unit in the series is the ASM.6, which is also the most powerful and efficient Mamba yet developed. At present undergoing flight trials in a Dakota, it has been quoted as the eventual power unit for the Short Seamew. Initially developed for the Gannet, the Double Mamba is formed by attaching the power sections of two Mambas to a common gearbox driving two separate co-axial airscrews. Each power section retains its own fuel, oil and control systems, and can be shut down independently of the other to permit extended economical cruising. Each drive includes a free-wheel, and the 100 s.h.p. accessory gearbox drive takes power from whichever engine is running the faster, although both sections can be synchronized. Carrier operations have caused the Double Mamba to be developed as a constant-speed engine; the same type of work is responsible for the fact that the engine can run on a variety of fuels, including marine diesel oil.

The ASMD.3, which is illustrated, consists of two annular-chamber ASM.5s, and is a more powerful and efficient engine than the ASMD.1; this engine is a stepping-stone to the powerful ASMD.4, about which nothing may yet be said.

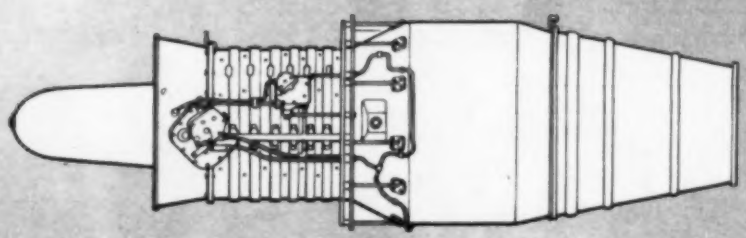
Armstrong Siddeley Sapphire This large axial turbojet was originally designed by Metropolitan-Vickers, but Armstrong Siddeley took it over in a still quite undeveloped state in 1948. They have since turned the Sapphire into a very valuable engine, which is in large-scale production in both Great Britain and the U.S.A. No details of the interior can be published, but full details of the layout of the American-made engine have been released across the Atlantic and were, in fact, published in our issue of June 18th this year. The American J65 Sapphire has an axial compressor with 13 stages, an annular combustion chamber with 36 "walking-stick" vaporizing burners and a two-stage turbine; the whole J-65 design seems singularly straightforward and efficient, although to what extent it differs in detail from the current British engine cannot be stated. The development of the Sapphire, at ratings between 7,000 and 7,500 lb, brought Great Britain a world rate-of-climb record in a Meteor; the latest publishable data are those given for the ASSa.6, and this type of engine has been exhibited at the S.B.A.C. show for two years past. There are, however, later types of Sapphire, and the ASSa.4, 5 and 7 can be listed as having run. These are members of a later family of Sapphires, and it may be expected that most members of this family will be given five-figure power ratings, i.e., over 10,000 lb thrust. Sapphires have also been tested with afterburners, and two such engines are undergoing tests in a Canberra. Production Sapphires from both Coventry and Brockworth, Gloucestershire, are being delivered to meet the requirements of the programmes for the Hunter, Victor, Javelin and English Electric P.1.



Armstrong Siddeley Sapphire ASSa.4 turbojet. Axial compressor, annular combustion chamber with vaporizing burners and two-stage turbine. Overall diameter, 37.4in; length, 134in; dry weight, 2,600 lb; maximum thrust, 8,300 lb at sea level at 8,600 r.p.m. with s.f.c. of 0.85 lb/hr/lb thrust.

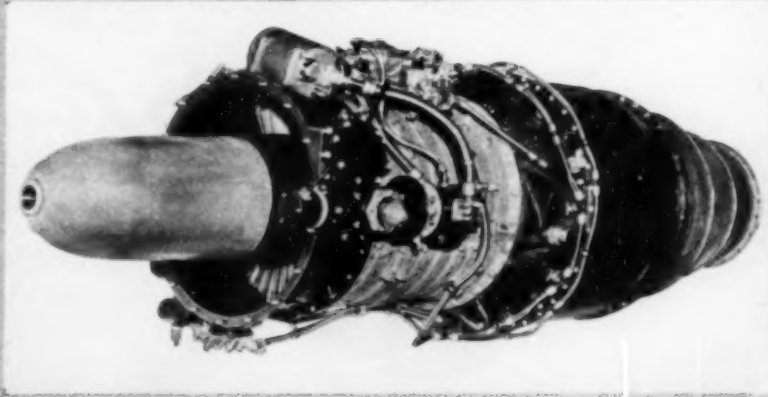


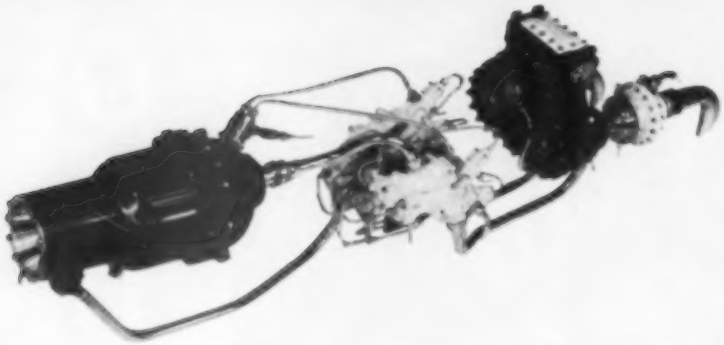
Armstrong Siddeley Viper This neat little turbojet was originally designed for the Australian Jindivik 2 pilotless aircraft, and it was accordingly prepared as an essentially simple, cheap, high-thrust engine, running fairly hot and with few expensive alloys in its construction, since long-life was not a requirement. So good was its endurance on test that a new requirement was written around it for its development as a long-life turbojet for piloted aircraft. A new range of Vipers was thus developed, with lower gas temperatures, better materials and other detail differences, and also equipped with all the accessories and starting equipment required by normal aircraft operation. The drawing shows the ASV.3, of 1,640 lb thrust, and this is typical of the earlier engines for Jindiviks; these have been in production for many months for shipment to Australia. Later "short-life" Vipers are cleared for considerably higher thrusts, the 1,900 lb ASV.6 listed in the data table (p. 370) being typical. The photograph shows a Viper 101 of the type used in the Jet Provost and Midge. This engine, of ASV.5 type, is some 90 lb heavier than the ASV.3, owing to its extra equipment; nevertheless, it remains one of the cheapest and lightest engines for its power yet developed. The resemblance to the Sapphire is more than superficial; the Viper employs a very similar annular combustion chamber, with vaporizing burners. The simple axial compressor rotor is assembled vertically, the blades being located between the peripheries of adjacent pairs of discs; the turbine nozzle guide vanes are fully floating within their retaining rings, so permitting free expansion.



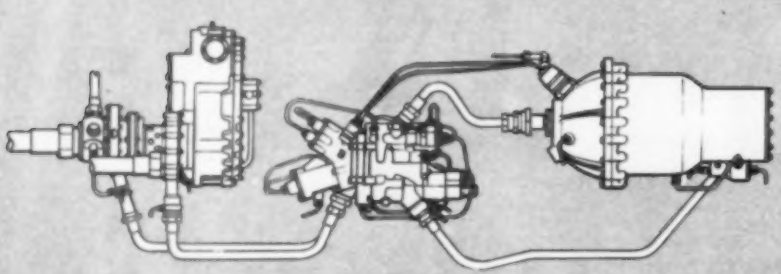
Armstrong Siddeley Viper ASV.3 turbojet. Seven-stage compressor, annular combustion chamber and single-stage turbine. Mass flow, 30 lb/sec with pressure ratio 3.5:1. Overall diameter, 24.7in; length, 65.4in; dry weight, 375 lb; maximum thrust, 1,640 lb at 13,400 r.p.m. with s.f.c. of 1.09 lb/hr/lb.

Armstrong Siddeley Viper ASV.5 turbojet. Seven-stage compressor, annular combustion chamber and single-stage turbine. Mass flow, 31 lb/sec. Overall diameter, 28in; length, 65.83in; dry weight, 465 lb; maximum thrust as for ASV.3.

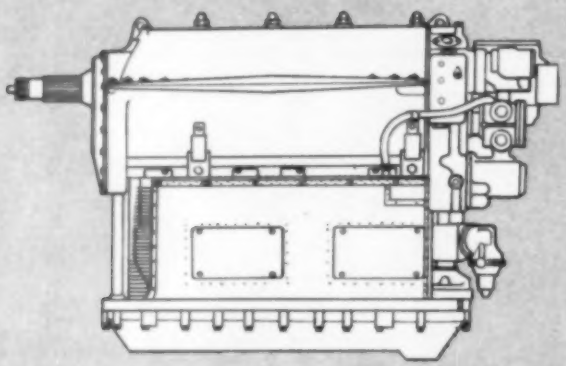




Armstrong Siddeley Snarler. Dimensions: chamber length, 25.4in to end o mounting cone; nozzle diameter, 5.41in; throat area, 5.21 sq in; characteristic length, 94in. Weight: gearbox, drive and pumps, about 77 lb; valves, filters, bottles and electric gear, about 57 lb; chamber and mounting, igniter, valves and electrical gear, about 79 lb; total, approximately 213 lb. Note: according to the S.B.A.C. definition of a motor the Snarler's dry weight would be about 166 lb. Performance: full thrust, about 2,000 lb at sea level, rising with altitude. Specific impulse, 195 maximum at sea level; maximum combustion chamber pressure, 300 lb/sq in; maximum combustion temperature, approximately 2,650 deg K; jet velocity, 6,270ft/sec.

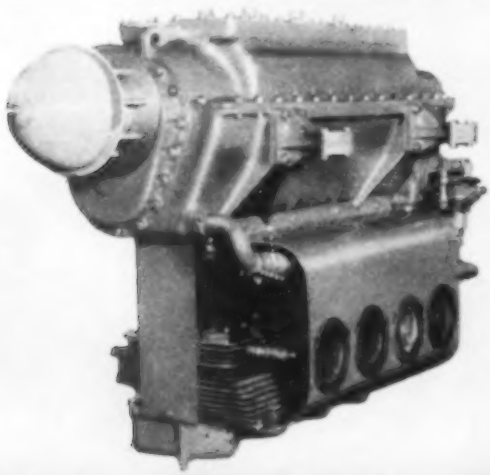


Armstrong Siddeley Snarler Fully described in our issue of August 6th this year, the Snarler was the first liquid-oxygen, pump-supplied rocket motor ever to be developed as a long-life power unit for piloted aircraft. Designed as a booster unit for fighters to give a sea-level thrust of 2,000 lb (and rather more at higher altitudes), the Snarler runs on liquid oxygen and a 65/35 per cent mixture of water and methanol. These propellants are supplied at high pressure by centrifugal pumps which feed the liquid oxygen to an injection nozzle at the head of the combustion chamber and the water-methanol mixture to a cooling jacket surrounding the chamber. From the cooling jacket it passes into the inner chamber through holes around the wall. Considerable development went into the design of the Snarler, its propellant pumps and its automatic control system, the latter being provided both to facilitate the starting-up procedure, and also to enable the Snarler to be controlled entirely by a single lever. As the Snarler is quite "non-secret" it can be inferred that development of this particular unit has ceased; yet Armstrong Siddeley have a large and expanding rocket division, and so successors to the Snarler can confidently be awaited. It should be noted that a liquid-propellant rocket such as the Snarler can be disposed in any suitable manner throughout an aircraft; for example, in the Snarler-equipped Hawker P.1072, the chamber was mounted in the tail, the control valves were placed under the fin and the pumps and air bottles were mounted forward of the wing. The drawing shows the pump, valves and chamber, from left to right.



Cirrus Bombardier 702, of same layout as Cirrus Minor, but with direct fuel injection. Bore, 4.8in; stroke, 5.5in; swept volume, 389.12 cu in (6.524 litres); width, 17.2in; height, 31.1in; length, 46.8in; dry weight, 350 lb; maximum power, 175-200 b.h.p. at 2,600 r.p.m. at sea level.

Cirrus Minor 2A direct-drive, unsupercharged, air-cooled, poppet-valve, inverted four-in-line piston engine. Bore, 3.9in; stroke, 5in; swept volume, 243.5 cu in (3.99 litres); width, 18in; height, 25.5in; length, 40in; dry weight, 234 lb; maximum power, 100 b.h.p. at 2,600 r.p.m. at sea level.



Blackburn Cirrus Piston Engines The two stalwarts of the Cirrus Engine division of Blackburn and General Aircraft continue to be the Cirrus Minor and Cirrus Major, both of which are four-in-line inverted air-cooled units, with a direct drive. Both have been steadily developed during the past year, a particular step forward being the Cirrus Minor 2A, illustrated, which is stronger than previous Minors and has higher overspeed r.p.m. The Minor and Major data are given in the table on p. 370. The most important Blackburn piston engine, however, is now the post-war Bombardier. Also an inverted four-in-line unit, the Bombardier has an underhead camshaft, direct fuel injection, and can be equipped with any modern accessory, including such items as a constant-speed unit and a cartridge starter. The Bombardier is in production for such aircraft as the Auster A.O.P.9 and the Saro Skeeter helicopter. For Army use, it has been developed to run on ordinary M.T. petrol, at a rating of about 173 h.p.; on higher-octane aviation fuel, however, over 200 h.p. has been obtained. The features of the Bombardier are well brought out by the drawing, which shows the clean exterior. Several major parts of the structure are made of magnesium alloy. Further development is aimed at making the engine still more efficient and powerful. The Cirrus Engine division are also commencing production of various units in the range of small gas turbines developed by Turboméca in France. Details of the three units in which Blackburn are particularly interested are given on p. 370; they will be made by the British company in a modified form.

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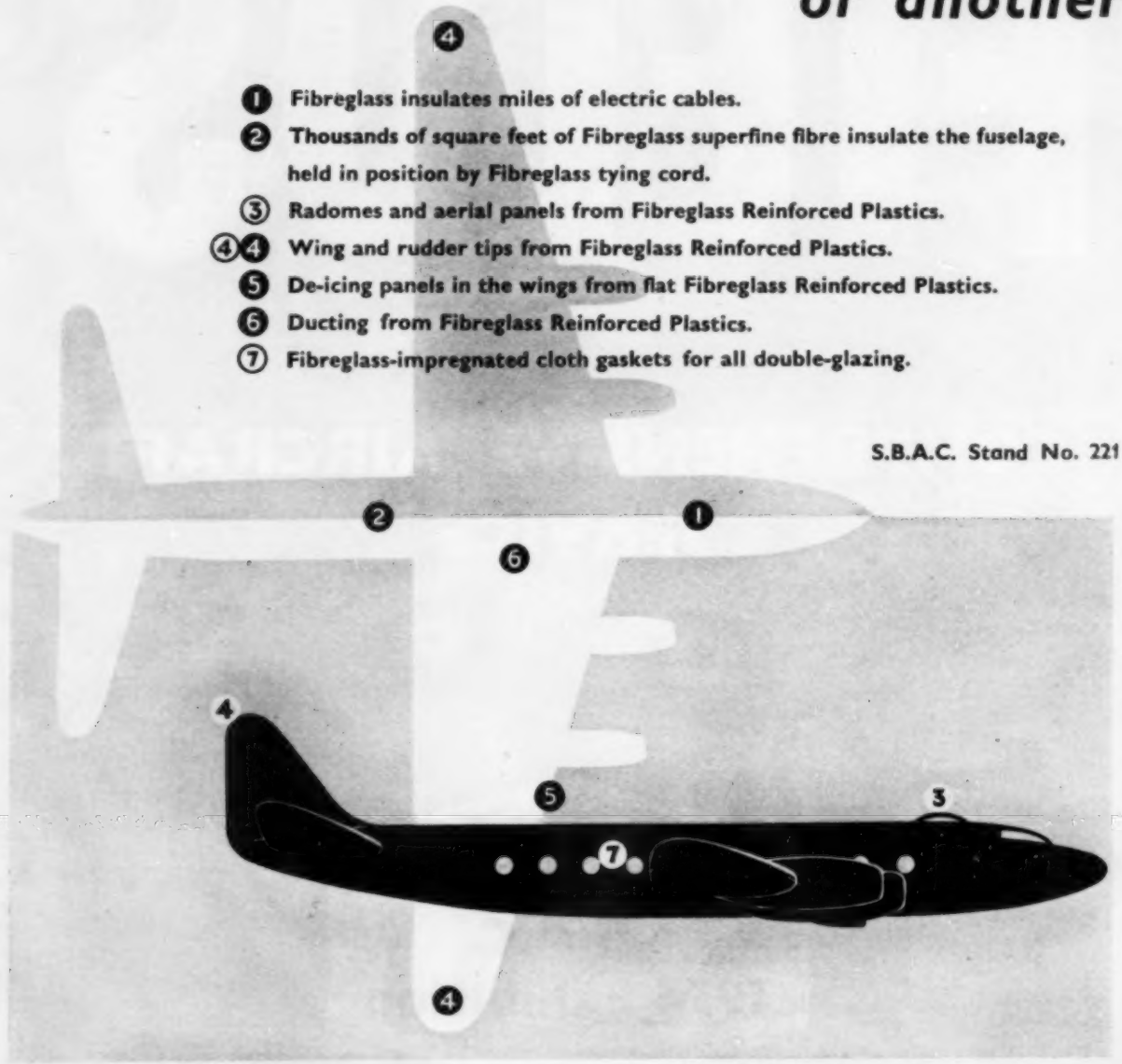

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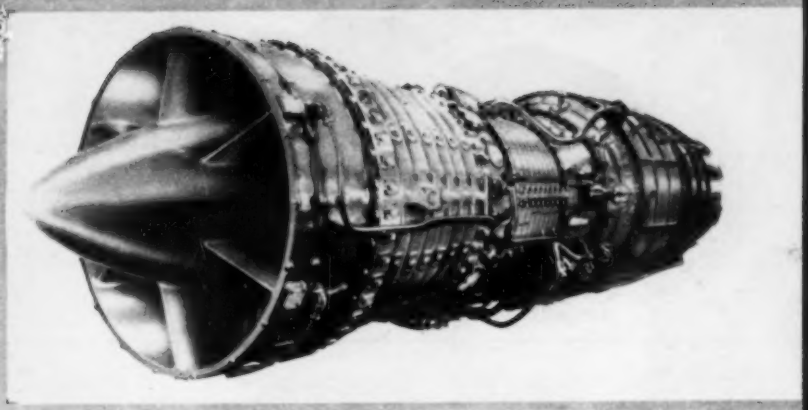
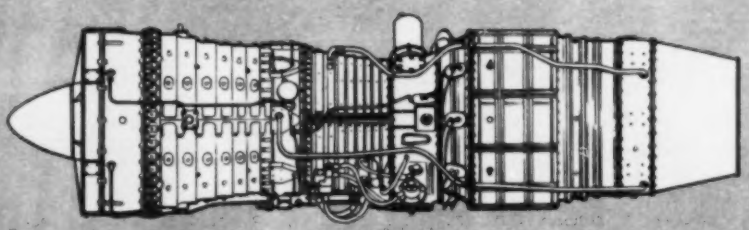
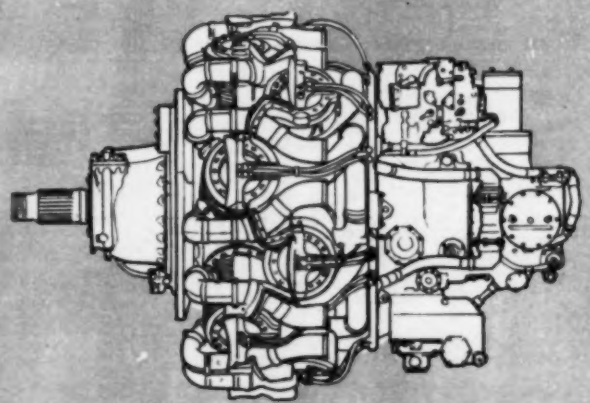
Bristol Turbojets The first production-type turbojet of Bristol design, the Olympus was also the first engine to have what is colloquially known as "two-spool" compression, having been designed and built some two years before the Pratt and Whitney J57 of similar layout. The main rotating parts of the compressor are divided into two mechanically independent halves, one a high-pressure assembly and the other a larger low-pressure unit turning at lower r.p.m. It may be apparent that the high-pressure (or central) assembly consists of the rear compressor and front turbine(s), both units being mounted on a tube; down the centre of this tube passes the drive shaft linking the low-pressure components. During starting only the H.P. assembly is driven, the L.P. section gradually speeding up as the gas flow builds up. In normal running, both assemblies automatically match themselves and provide excellent engine control and performance. It is also possible to obtain a much higher pressure ratio for a given number of axial stages, so improving efficiency. The Olympus certainly has high efficiency, and it has run successfully at heights well over 60,000ft. (It holds the world height record in a Canberra at 63,668ft.) Unfortunately, the Bristol company are unable for security reasons to quote data for, or exhibit, a more modern engine than the BO1.1 illustrated. This is galling for them for the 9,750 lb maximum rating bears, we are told, "no relation to the [current] truth." Bristols also have a very light and compact medium-power turbojet named Orpheus, now being rapidly developed for several projected aircraft.



Bristol Olympus BOL1 two-spool turbojet. The compressor consists of two independent axial units driven by separate turbines. An annular combustion chamber is fitted. Diameter, 40in; length, 124in; dry weight, 3,520 lb; maximum power for publication, 9,750 lb thrust, with s.f.c. of 0.766 lb/hr/lb.

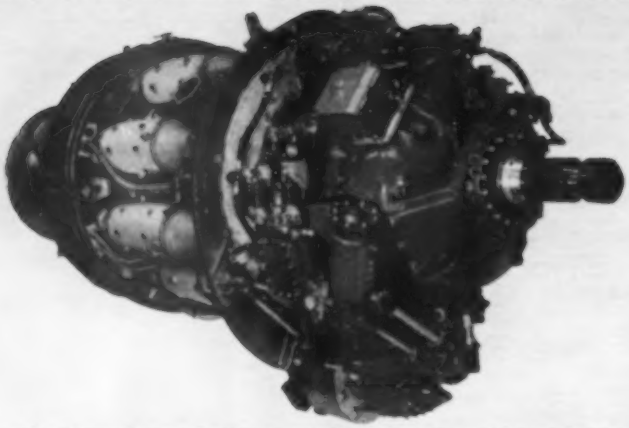


Bristol Piston Engines Since before 1939, nearly all the reciprocating-engine development at Bristol has centred on large, two-row radial engines with sleeve valves. These valves have a number of advantages, including better volumetric efficiency and a reduction in the number of parts required. After World War 2, during which over 70,000 Hercules were made, the engine was completely redesigned, to produce higher power and to fit it for extended service in military and civil aircraft in all parts of the world. Most of the engines now in use are cleared to run for more than 1,000 hours between overhauls, and this period is steadily being extended. Engines in the 730 and 750 series are still being manufactured, and similar engines are being made in France. These have single-speed superchargers, and are used in such aircraft as the Nord Noratlas and Bristol Freighter. The larger, 18-cylinder Centaurus is also in production, principally in Series 173 form for the Blackburn Beverley. This unit has a single-speed supercharger and gives more power for take-off than does the two-speed Series 661 used in the D.H./Airspeed Ambassador. The latter engine is now approved for a 1,000-hr overhaul period, and this figure is also likely to increase. Other types of Centaurus are serving in various military and naval aircraft; from the point of view of swept volume, these are the largest British piston engines ever to see service. All the latest Bristol reciprocating engines are installed in low-drag, free-exit cowlings, and fan-cooling is provided for aircraft such as the Beverley.



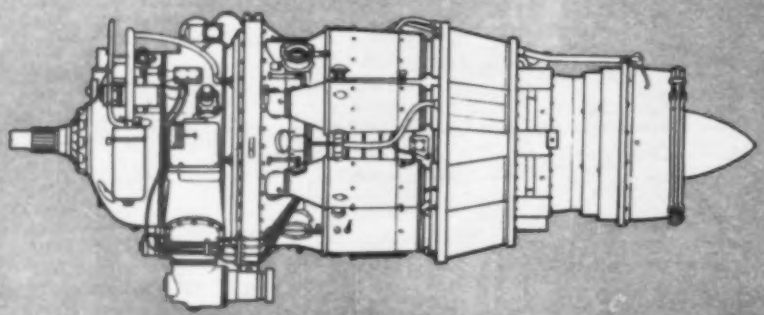
Bristol Hercules 758, fourteen-cylinder, two-row, sleeve-valve, air-cooled radial, with two-speed blower, copper cylinder heads, and provision for 150 h.p. accessory drive and reverse-pitch airscrew. Bore, 5.75in; stroke, 6.5in; swept volume, 2,360 cu in (38.7 litres); diameter, 52in; length, 70.8in; dry weight, 2,165 lb; maximum power, 2,090 b.h.p. at 2,800 r.p.m. at 13 lb boost at 3,000ft.

Bristol Centaurus 661, eighteen-cylinder, two-row, sleeve-valve, air-cooled radial geared and fitted with two-speed supercharger. Bore, 5.75in; stroke, 7in; swept volume, 3,270 cu in (53.6 litres); diameter, 56.4in; length, 74in; dry weight, 3,400 lb; maximum power, 2,705 b.h.p. at 2,800 r.p.m. at 13.8 lb boost at 4,000ft.

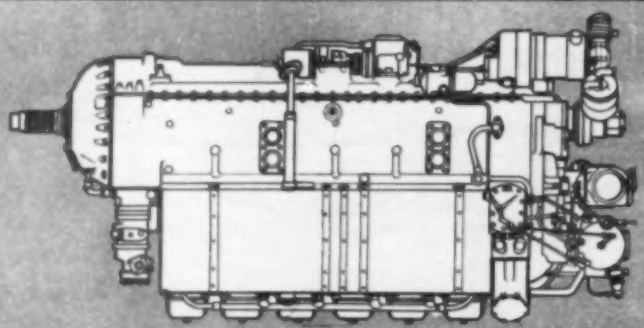


Bristol Proteus 753 of similar layout to engine below. Data similar, except: diameter, 40.1in; length, 108.7in; dry weight, 3,000 lb; mass flow, 47 lb/sec; maximum power, 3,650 s.h.p. plus 1,320 lb thrust, giving 4,150 e.s.h.p. at 12,000 compressor r.p.m.

Bristol Proteus 705 free-turbine reverse-flow turboprop. Compressor has 12 axial and one centrifugal stage, driven by two-stage turbine. Aircrew gearbox (0.09:1) driven by separate two-stage turbine. Eight, reverse-flow combustion chambers. Diameter, 39.5in; length, 113in; dry weight, 2,850 lb; mass flow, 44 lb/sec; pressure ratio, 7.2:1; maximum power, 3,320 s.h.p. plus 1,200 lb thrust, giving 3,700 e.s.h.p., at 11,700 compressor r.p.m.; cruising s.f.c. at 35,000ft, 0.495 lb/hr/e.s.h.p.

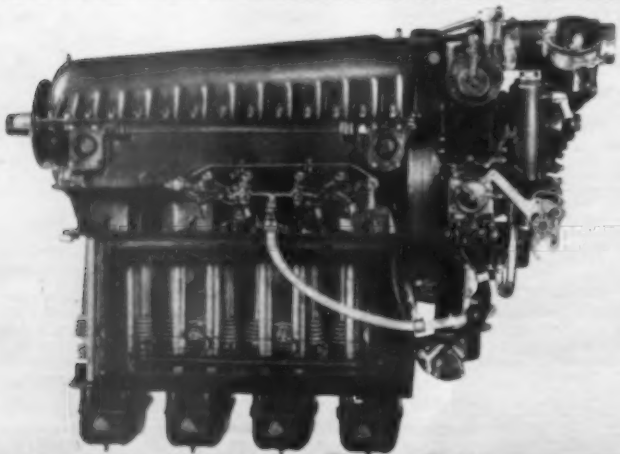


Bristol Turboprops Probably further advanced in development than any other shaft-drive turbine of similar power, the Proteus is now almost ready to take its place as a standard commercial power unit on the world's airways, in the Britannia airliner for which it was designed. The length of the Proteus has been kept down by adopting a reverse-flow layout, in which the intakes are at the rear; the air passes forwards through twelve axial stages, is flung out from a centrifugal stage and then passes to the rear again through the eight cans. Two separate pairs of turbines are used to drive the compressor and airscrew gearbox, and a safety device has been introduced to prevent dangerous overspeeding of the power turbine should the torquemeter pressure ever fall below a given limit. The first 15 Britannias are powered by the Proteus 705, shown in the drawing; later aircraft will have the more powerful Proteus 755 which has already been very highly developed. This engine runs at 12,000 compressor r.p.m., and has a revised accessory drive. It also provides for bleeding of air for cabin pressurization. The engines now in production have full protection against ice, and a new double-helical reduction gear has been developed. This has run a very successful series of tests totalling 1,000 hr. Equipment includes an Ultra electric control system and synchronization circuits. Total flight time exceeds 3,300 and over 23,000 hr have been run on the bench. It has been reported that an entirely new Bristol turboprop, employing two-spool compression, is being developed. An American journal has said that this engine would have a constant rated power at all altitudes up to about 20,000ft; if so, this would be the first gas turbine not designed as a full-throttle engine.



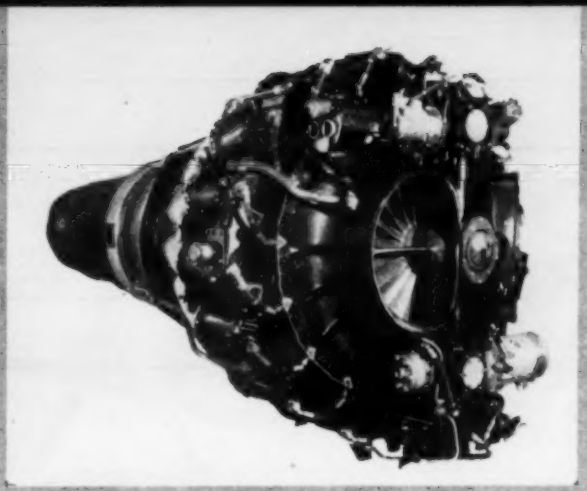
de Havilland Gipsy Queen 70 Mk 2 air-cooled, poppet-valve, inverted six-in-line piston engine, geared and supercharged, with injection carburettor. Bore, 4.72in; stroke, 5.9in; swept volume, 622 cu in (10.2 litres); width, 18.7in; height, 33in; length, 70.8in; dry weight, 690 lb; maximum power, 380 b.h.p. at 3,000 r.p.m. at 7.5 lb boost at sea level.

de Havilland Gipsy Major 10 air-cooled, poppet-valve, inverted four-in-line piston engine, ungeared and unsupercharged. Bore, 4.46in; stroke, 5.91in; swept volume, 374 cu in (6.1 litres); width, 28in; height, 30.5in; length, 45.4in; dry weight, 325 lb; maximum power, 145 b.h.p. at 2,550 r.p.m.



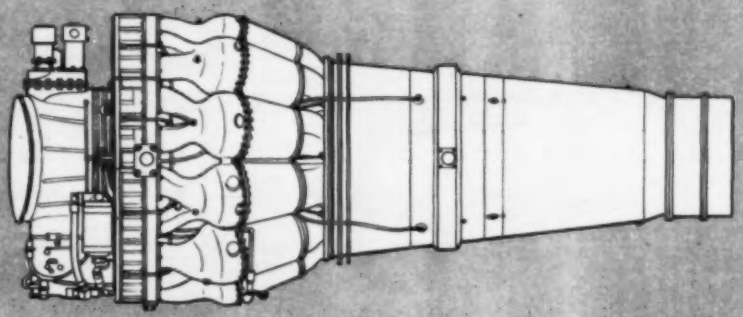
de Havilland Piston Engines Many thousands of Gipsy inverted in-line air-cooled engines were made before and during the second World War, and the name became synonymous with reliability. At the end of that conflict the de Havilland company prepared a whole new range of engines, most of which were completely redesigned in the light of the immense experience which had by then been amassed. The most widely used four-cylinder engine since the war has been the Gipsy Major 10, shown below on the left. The cylinders are very slightly larger than those used in pre-war Majors, and—unusually—a venturi-type carburettor is retained. Now, however, it can be revealed that development is proceeding on still another new range of Majors embodying direct-injection fuel systems. Already the power being taken from these engines exceeds 200 h.p., and development is continuing. Regarding six-cylinder engines, the Queen Series 30 (Heron) and Series 70 (Dove) have had great success, and both are now in world-wide service. The former is supplied as a basic engine, mounted in the airframe in a conventional manner; it is ungeared and unsupercharged. The 70 Series is made up as a complete cowled engine-change unit, and it has a supercharger and reduction gear. Another feature of the 70 is an injection-type carburettor. Normally, the Queen 70 drives a three-blade airscrew, with both feathering and constant-speed (and, on occasion, reversing) capabilities; the Heron's Queen 30s drive two-blade airscrews and, so extraordinarily good is the engine's record of reliability, the A.R.B. do not require these airscrews to feather.

de Havilland Turbojets It is a remarkable fact that the D.H. Goblin turbojet, designed as long ago as 1941 as the Halford H.1, is still in full production today. Of exceptionally simple and rugged design, the Goblin has a single-sided centrifugal compressor and no fewer than 16 cans. Thousands of Goblins have been made for the various marks of Vampire, and the Goblin 35 is in production for the export D.H.115 and R.A.F. and Royal Naval Vampire Trainers. Compared with earlier Goblins, the Mk 3 engine produces an increase in thrust by running at higher r.p.m., and the Mk 35 has a smaller nozzle, and so runs rather hotter and gives still greater thrust. The larger Ghost has a considerably greater mass flow and pressure-ratio. Two unusual features of the engine are the manner in which the ten cans are fed by twenty diffuser outlet ducts, and the fact that the fuel system works at no less than 2,000 lb/sq in. The engine most commonly found in service is the Ghost 103, virtually identical with the Ghost 48 licence-built by the Italian Fiat company. Compared with the single-intake Ghost, the Ghost 48 and 103 have a slightly reduced rating of 4,850 lb. All that can officially be said about the Halford H.4 or Gyron engine is that it is to be a large, axial-flow turbojet with a thrust greater than that announced for any other engine. In the first instance, at least, it will be used in supersonic applications. The second sentence provides the key to the *raison d'être* of this engine; a brief consideration of the pressures and temperatures inherent in such applications makes it fairly evident that the Gyron will be exceptionally robust, as well as being almost entirely of steel. Flight testing of two Gyrons is taking place, the test-bed being a Short S.A.4.

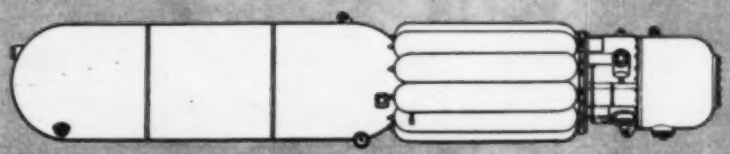


de Havilland Goblin 35 turbojet. Single-stage, single-sided centrifugal compressor, 16 combustion chambers and single-stage turbine. Diameter, 49.85in; length, 100.5in; dry weight, 1,629 lb; mass flow, 63 lb/sec; pressure ratio, 3.67:1; maximum thrust, 3,500 lb at 10,750 r.p.m. at sea level; s.f.c., 1.14 lb/hr/lb.

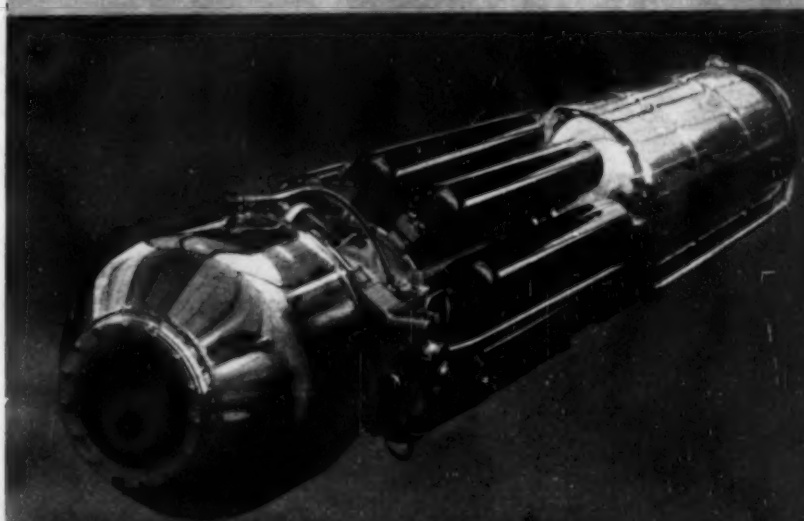
de Havilland Ghost 103 turbojet. Single-sided centrifugal compressor, 10 combustion chambers and single-stage turbine. Diameter, 53in; length, 130.5in; dry weight, 2,175 lb; mass flow, 88 lb/sec; pressure ratio, 4.5:1; maximum thrust, 4,850 lb at 10,250 r.p.m. with s.f.c. of 1.09 lb/hr/lb.

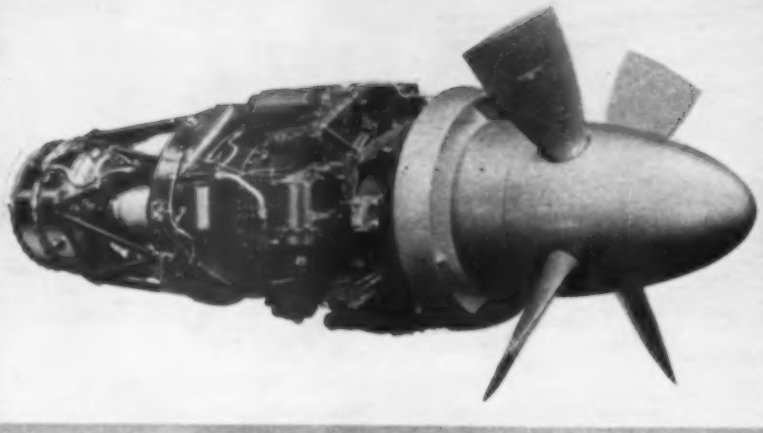


de Havilland Rockets The first assisted-take-off rocket of de Havilland design was the Sprite, which was originally intended for use on the Comet 1 and flew in that aircraft early in 1951. The propellent selected was concentrated hydrogen peroxide, which was fed under nitrogen pressure and mixed with a permanganate catalyst in the reaction chamber. The subsequent violent dissociation of the peroxide into superheated steam and free oxygen resulted in the formation of a propulsive jet, stained a muddy colour owing to the presence of the catalyst. Because its reaction temperature was less than 600 deg C, the Sprite was what is known as a cold rocket. The next, and far more important, D.H. rocket was named Super Sprite, since it is very closely related to its forebear. Externally, the chief difference is the larger peroxide tank, which makes possible runs of greater duration. More significant is the fact that the Super Sprite is able to run as a hot rocket, with hydrocarbon (gas turbine) fuel injected into the chamber to burn in the free oxygen. The peroxide is no longer mixed with a liquid catalyst; instead it is passed through the catalyst, the latter being in the form of a metal gauze. The Super Sprite is now going into production as an a.t.o. unit for an unspecified aircraft. On this aircraft, two Super Sprites will be mounted on the fuselage in streamlined packs, which can be jettisoned, lowered by parachute, recovered and used again. It has also been stated that de Havilland have other types of rocket under development, some being of great thrust and for uses in addition to that of a.t.o. booster.

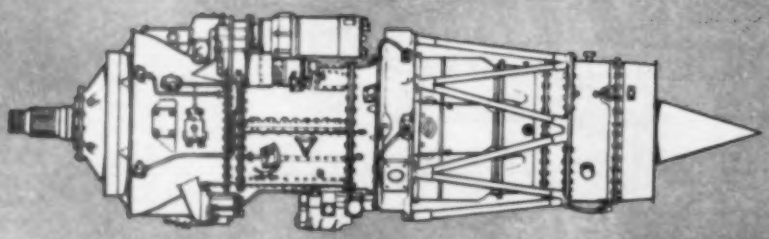


de Havilland Super Sprite, a.t.o. rocket using high-test peroxide and a hydrocarbon fuel. Diameter, 19.5in; length, 117.5in; empty weight, 600 lb; total impulse, 120,000 lb/sec, consuming some 55 gal H_2O_2 and 5 gal hydrocarbon fuel; maximum thrust, 4,200 lb; specific impulse, 150 sec. This rocket is to be manufactured as a complete jettisonable pack, embodying a parachute and inflatable shock-absorbing bag on the underside. With its light-alloy cowling, this pack weighs 1,900 lb.

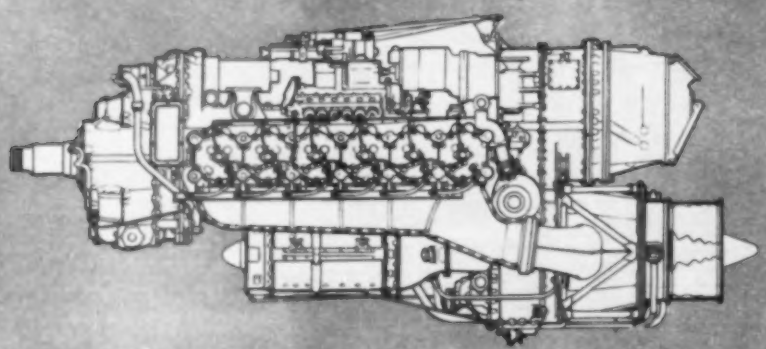




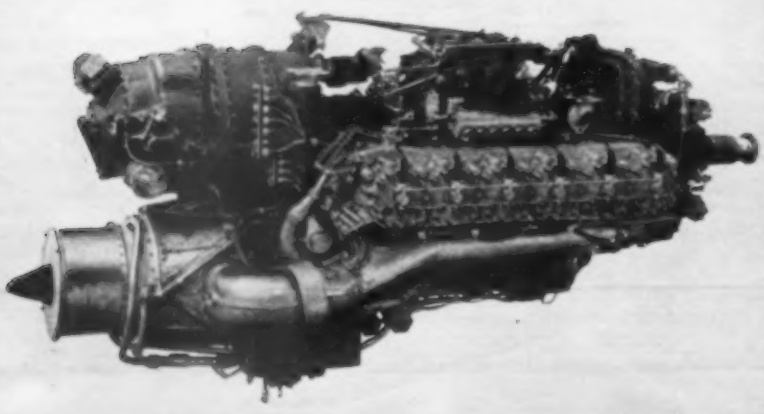
Napier Eland single-shaft turboprop. Two-stage compressor, six combustion chambers and three-stage turbine. Diameter, 36.1in; length, 104.5in; dry weight, 1,575 lb; mass flow, 31 lb/sec; pressure ratio, 7.0:1; maximum power, 2,690 s.h.p. plus 825 lb thrust, giving 3,007 e.s.h.p. at 12,500 r.p.m. with s.f.c. of 0.624 lb/hr/e.s.h.p.; typical cruising s.f.c., 0.480 lb/hr/e.s.h.p. at 35,000ft.



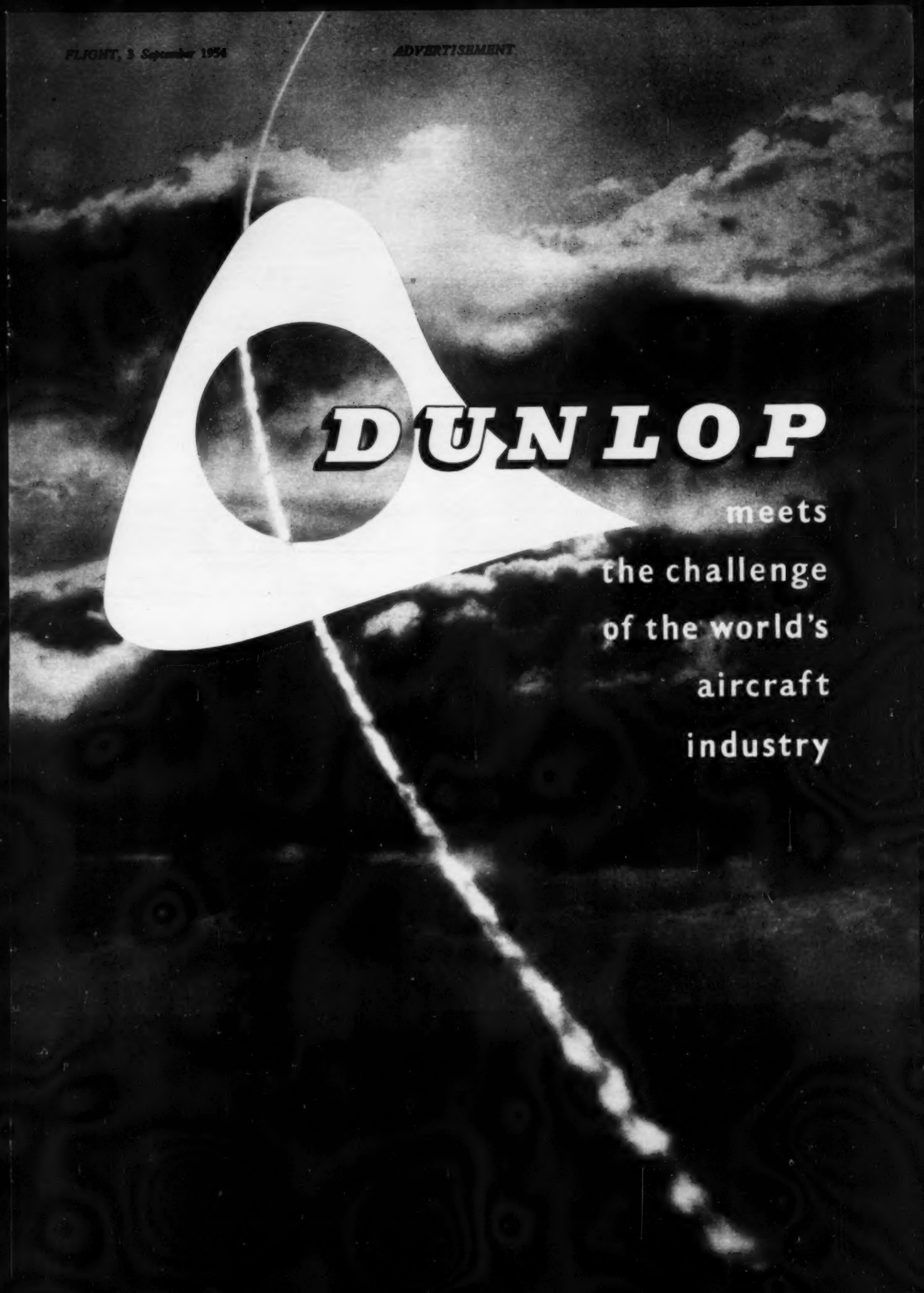
Napier Eland This turboprop is now, after extensive development, undergoing trials in a Vickers Varsity. Indicative of the Eland's high quality are its power/weight ratio, power per unit of frontal area, power per unit of installed drag and mechanical efficiency, all of which are higher than corresponding values for any other turboprop yet flown. Throughout the engine there is evidence of neat or ingenious design, the manner in which components can be changed without removing the engine from the airframe being typical. Engine control is claimed to be of an exceptional order; it is assisted by a quick-response turbine-inlet temperature control coupled with variable incidence compressor inlet guide vanes. Upstream burners are fitted to the Lucas-developed combustion system, and the unusually efficient reduction gear includes a built-in torquemeter of great accuracy. A special type of Eland is being actively developed for installation in the Fairey Rotodyne and other aircraft with tip-drive rotors. These Elands will, of course, differ somewhat from the simpler fixed-wing engine, for they will have to act as gas producers for the rotor during take-off as well as providing shaft power for an airscrew in forward flight. One factor common to all Elands is the commendable attention which has been paid to accessibility and maintenance. Although the outside diameter of the cowling is less than 37in, every accessory is immediately laid bare on opening the cowling; indicative of the ease of changing components is the fact that the three turbine stages can be removed in 15 minutes (providing the engine is cold) and a combustion chamber in five.



Napier Nomad NNm 6 compounded gas turbine/diesel engine. Two-stroke, liquid-cooled compression-ignition engine with 12 valveless cylinders, coupled with axial compressor and exhaust-gas turbine, all delivering power at single airscrew shaft. Width, 58.8in; height, 53in; length, 119in; dry weight, 3,960 lb; sweep volume, 41.1 litres; overall pressure ratio, 21.5:1; maximum power, 3,850 s.h.p. plus 320 lb thrust at 2,650 crankshaft and 19,500 compressor r.p.m., giving 3,135 e.s.h.p.; s.f.c., 0.33 to 0.35 lb/hr/e.s.h.p. under all flight conditions.



Napier Nomad This remarkable engine is the most notable attempt yet made at establishing a wholly new level of thermodynamic efficiency among aircraft power units. The efficiencies of the Nomad are, in fact, considerably better than the corresponding values now accepted for large ground-service power units. The basis of the unit is a two-stroke compression-ignition engine, with twelve liquid-cooled horizontally opposed valveless cylinders. This section drives a single-rotation airscrew, and its exhaust drives a gas turbine. This turbine, in turn, supplies power to an axial compressor which supercharges the diesel component to a high degree. Further, the gas turbine and diesel crankshaft are mechanically coupled by a gear train in which is inserted an infinitely-variable-ratio gear. This makes the engine flexible for control, efficient at all altitudes and climatic conditions and also allows the diesel to drive the axial compressor during starting and the gas turbine to assist in driving the airscrew in cruising flight. The overall compression and expansion ratios are unprecedented; as a result the efficiency of the Nomad cannot be matched at any point by any other aero engine. The consumption curves of the Nomad are almost straight lines at constant values across the whole operating range of powers and altitudes, and the fact that the turbine and diesel were matched from the start is a great advantage. The Nomad can be run on any grade of petrol, kerosine, or pool gas oil. The power/weight ratio, already good, can be increased by water injection and afterburning.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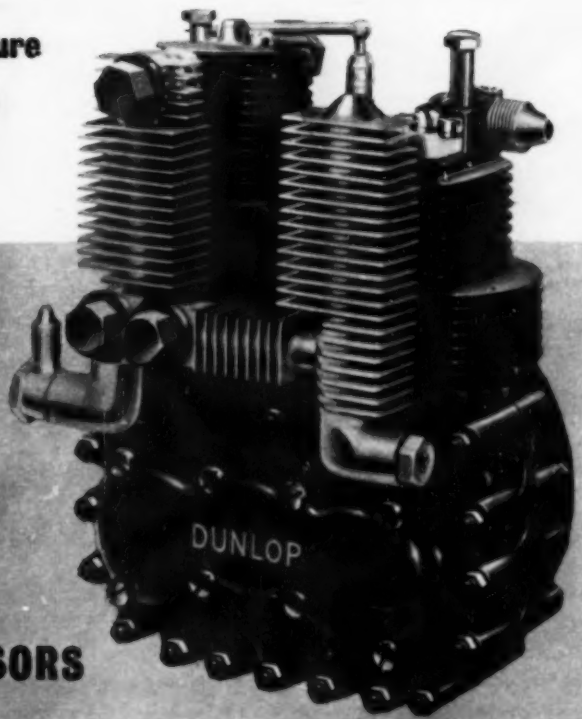

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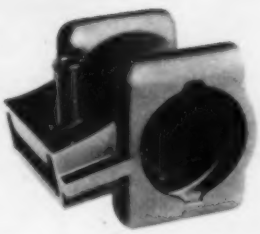

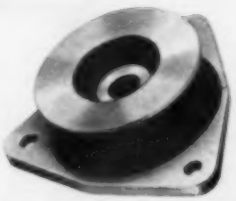

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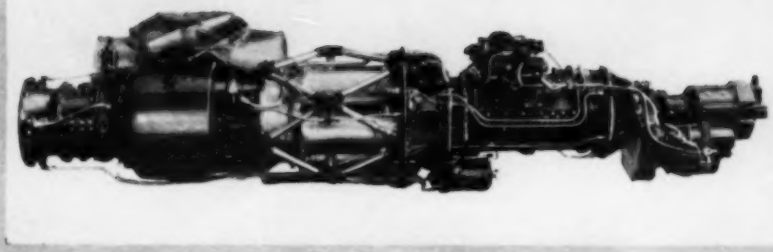
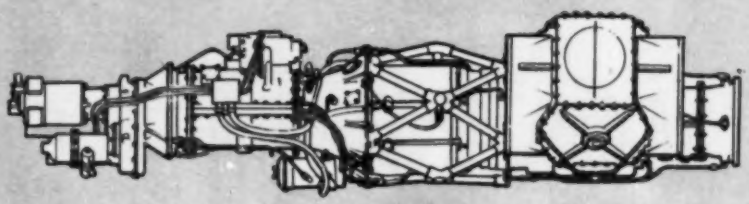
4H/619A

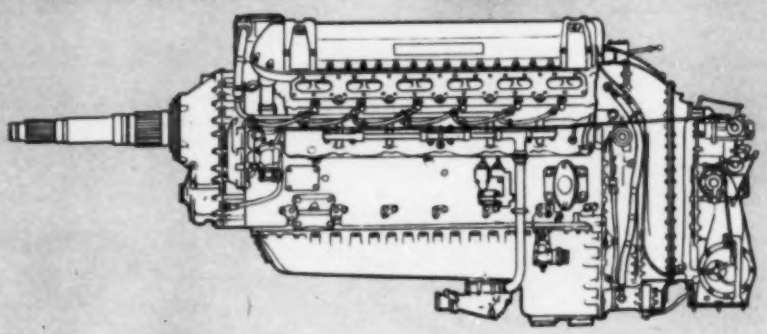
Napier Oryx This unusual, and very attractive, little gas turbine is being publicly displayed at the forthcoming S.B.A.C. show for the first time. The Oryx has been developed by the Napier company to Ministry of Supply development contract, and the makers are consequently able to release only very limited information on it. The Oryx's function is to supply a steady flow of hot gas, at a relatively low pressure, to a power-producing section remote from the Oryx itself. Thus, the gas could be fed to a power turbine driving propulsive airscrews; alternatively (and it is in this second application that the Oryx will find its principal applications), the gas can be ducted to the hollow blades of a helicopter rotor in order to feed propulsive jets at the blade tips. Readers will no doubt be inclined to associate the Oryx with the Percival P.74, which has been stated to be powered by a Napier low-pressure gas system. The photograph illustrates the main features of the unit, and it will be seen that an axial compressor is employed—possibly the smallest axial ever employed on an aero engine. This takes in air from an intake behind the accessories mounted on the nose, and passes it to the five chambers, around which can be seen bracing tubes. There appears to be a second compressor at the rear of the Oryx, and a large air box and throttle valve can be seen attached to the left-hand side of the unit at an inclined angle. The figure of 750 gas horsepower would seem to fit the Oryx to a variety of aircraft types, some of which are already flying with much heavier piston engines.



Napier Oryx turbo gas generator. Axial compressor and five separate combustion chambers. Maximum diameter, 19½in; length as shown, 76in; dry weight, 495 lb; maximum sea-level output, 750 gas horsepower with specific fuel consumption of 0.68 lb/hr/g.h.p.

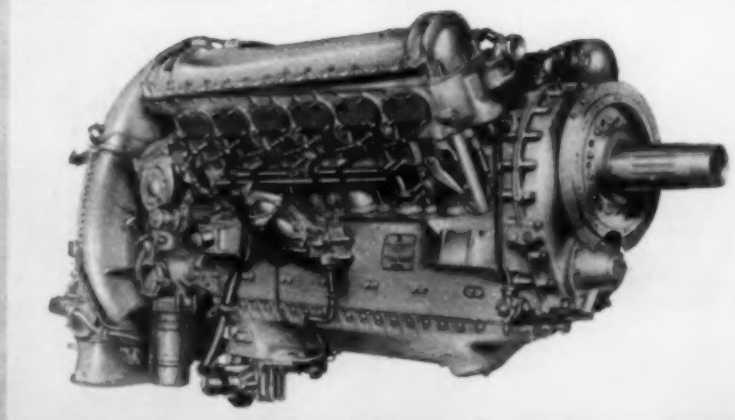


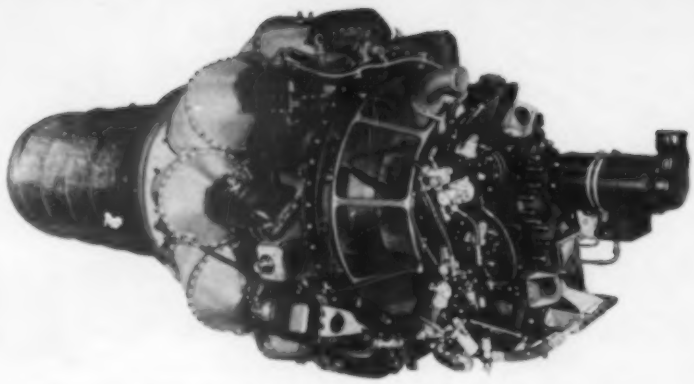
Rolls-Royce Piston Engines The neat 27-litre Merlin was probably the most important Allied engine in World War 2, and the 150,000 that were built played a dominant part in establishing our fighter and bomber supremacy. Even today, Merlins are still in limited demand in this country, for the Boulton Paul Balliol trainer; this aircraft, of the R.A.F. and R.N., uses the Merlin 35 single-stage, single-speed engine, de-rated to about 1,280 h.p. A very different type of Merlin is the transport Merlin 720 series, which has amassed a seven-figure hourage with Argonaut and North Star transports. These engines have two-speed, two-stage superchargers and intercoolers, and give a good cruising power at heights around 22,000ft. Thus, the Canadair transports are able to cruise over most of the weather at a high true air-speed. These engines are made up as complete engine-change units, with cowling and exhaust system, the latter now being of a "cross-over" type which greatly reduces noise and also improves engine efficiency. The larger Griffon continues in production, principally for the Shackleton. This aircraft has four Griffons, of the type shown in the drawing. Other types of Griffon are still used in such aircraft as the Firefly and Spitfire/Seafire. Most of the naval Griffons are single-stage engines driving single-rotation airscrews, and cartridge starting is usual for carrier operation. It is remarkable that, in spite of their extensive equipment, automatic control systems and great reliability, the 57-series Griffon should have a power/weight ratio unexcelled by any other piston engine in service anywhere.



Rolls-Royce Griffon 57 twelve-cylinder, poppet-valve, pressure liquid cooled, 60-deg vee piston engine, geared to contra-rotating airscrew shafts and fitted with a fuel-injection pump, two-speed, single-stage supercharger. Bore, 6in; stroke, 6.6in; swept volume, 2,239 cu in (36.7 litres); width, 32in; height, 41.5in; length, 83.6in; dry weight, 2,090 lb; maximum power, 2,455 b.h.p. at 2,750 r.p.m. at 25 lb boost at sea level, with water-methanol injection.

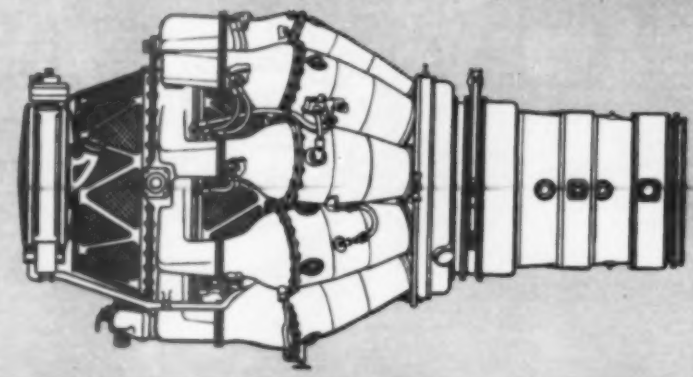
Rolls-Royce Merlin 724 twelve-cylinder, poppet-valve, liquid-cooled 60-deg vee piston engine, with two-stage, two-speed supercharger and intercooler. Bore, 5.4in; stroke, 6in; swept volume, 1,649 cu in (27 litres); width, 30.1in; height, 43.2in; length, 77in; dry weight, 1,790 lb; maximum power, 1,760 b.h.p. at 3,000 r.p.m. at 20.5 lb boost at sea level.



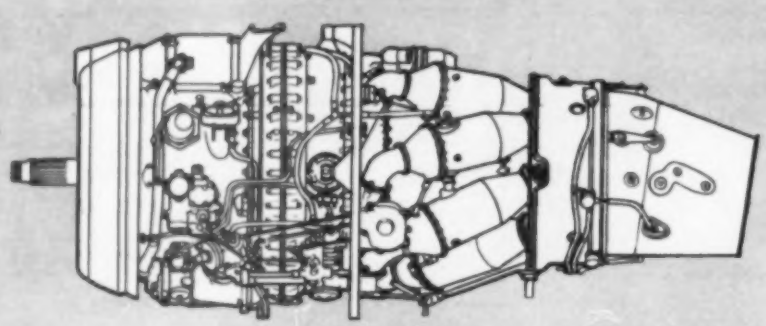


Rolls-Royce Nene 10 turbojet. Single double-sided centrifugal compressor, nine combustion chambers and single-stage turbine. Diameter, 49.5in; length, 104in; dry weight, 1,610 lb; mass flow, 90 lb/sec; pressure ratio, 4.5: 1; maximum thrust, 5,100 lb at 12,500 r.p.m. with s.f.c. of 1.00 lb/hr/lb.

Rolls-Royce Derwent RD.8 turbojet. Single double-sided centrifugal compressor, nine combustion chambers and single-stage turbine. Diameter, 43in; length, 83.1in; dry weight, 1,280 lb; mass flow, 63.9 lb/sec; pressure ratio, 4.1: 1; maximum thrust, 3,600 lb at 14,700 r.p.m. with s.f.c. of 1.01 lb/hr/lb.



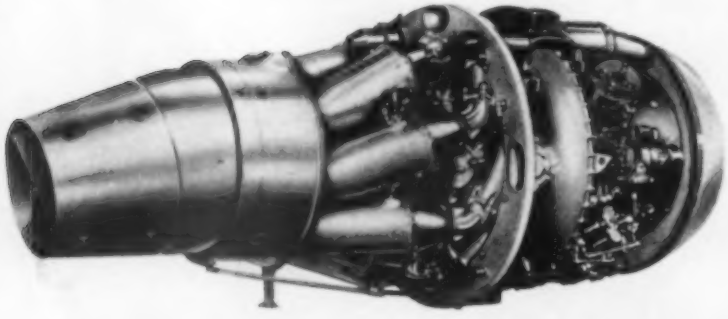
Rolls-Royce Centrifugal Turbojets During the past year, the Derwent and Nene have both remained in full production in Great Britain, and the Nene has also gone into production at the Montreal factory of Rolls-Royce Canada, for Canadair-built T-33AN trainers. Nearly all the Derwents built have gone to the various types of Gloster or Armstrong Whitworth Meteor which were built during the year, and the total Derwent flight time now amounts to well over 2½m hr. No major changes have recently been introduced in this engine. The Nene is at present a standard fighter power unit of the Royal Navy, for it is used in the Hawker Sea Hawk (with a cartridge starter) and the Supermarine Attacker (with an electric starter). The former aircraft has an unusual form of bifurcated jet-pipe which exhausts on either side of the rear fuselage. Nenes are also being supplied to the Dutch Fokker company for S-14 trainers, and the engine has been made in France, Australia, the Argentine, Russia and the U.S.A., in various forms more or less similar to the basic Derby product. The version of the Nene illustrated is that made in Derby and Montreal for the T-33AN already referred to. About 900 of these engines are being built, the first batches being all-British, present production being British parts assembled in Canada, and the last batches being all Canadian. These are virtually the last engines directly descended from Whittle's classic turbojets of the 1937-41 era. There are no new centrifugal designs, except in the smallest power category.



Rolls-Royce Dart 505 single-shaft turboprop. Two single-sided centrifugal compressors in series, seven combustion chambers and two-stage turbine. Diameter, 37.9in; length, 95.1in; dry weight, 1,930 lb; mass flow 20 lb/sec; pressure ratio, 5.5: 1; maximum power, 1,400 s.h.p. plus 365 lb thrust, giving 1,515 e.s.h.p. at 14,500 r.p.m. with s.f.c. of 0.83 lb/hr/e.s.h.p.

Rolls-Royce Dart 510 (RDa.6), of identical layout to engine above. Length, 97in; dry weight, 1,107 lb; maximum power, 1,550 s.h.p. plus 365 lb thrust, giving 1,690 e.s.h.p. at 14,500 r.p.m., with specific fuel consumption of 0.705 lb/hr/e.s.h.p.

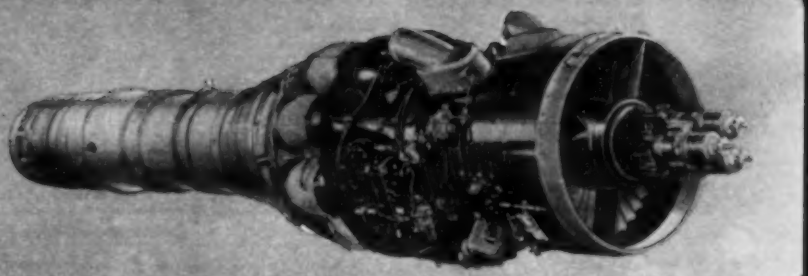
Rolls-Royce Turboprops Famous as the power unit of the Viscount, and destined to pass into world-wide service in that aircraft, the Dart is essentially a civil engine, with no military application to assist in speeding-up, and paying for, development. Its layout is novel, with two centrifugal compressors used in series. Pressure ratio is about 5.5 to 1. The arrangement of the combustion chambers is also unusual, for the seven chambers are mounted helically around the engine. The present Viscount engine is the Dart 505, at RDa.3 rating of 1,400 s.h.p. Features of these engines are high-energy ignition, shrouded turbine blades, two-piece compressor shafts and a water-methanol system, injecting into the eye of the first impeller, which restores full take-off power at tropical or high-altitude airfields. Numerous internal improvements have been made in the Dart 510, which runs at the RDa.6 rating of 1,550 s.h.p. This engine will power the 700D series of Viscounts now on order for a number of operators. A wholly new Rolls-Royce turboprop is (according to foreign reports) designated the RB.109. It is stated to be extremely compact and efficient, and powers as high as 4,400 h.p. are said to be within the unit's capabilities. In April of this year we were permitted to state that the company were actively developing a new turboprop, and that it would have an initial rating of some 2,500 h.p. This information, although correct at that time, does not reflect present Rolls-Royce work. The 2,500 h.p. engine has already been superseded by later developments.



Rolls-Royce Axial Turbojets There are many British rivers with the name Avon, which now also identifies the largest family of high-power turbojets in the world. The Avon was begun shortly after the war, when it was seen that centrifugal turbojets much bigger than the Nene would be likely to have prohibitive diameters. Not a great deal was known about axial compressors at that time, and Rolls-Royce needed about four years to get the first family of Avons right. These went into production in 1950 at a rating of 6,500 lb, for the Mk 2 Canberra. An unusual feature of these engines is the pneumatically actuated row of variable-incidence inlet guide vanes, and the compressor casing carries six bleed-valves which are open during starting and close only as pressure builds up. The prototype RA.2 weighed 2,400 lb and gave 6,000 lb thrust and the production RA.3 was 125 lb lighter.

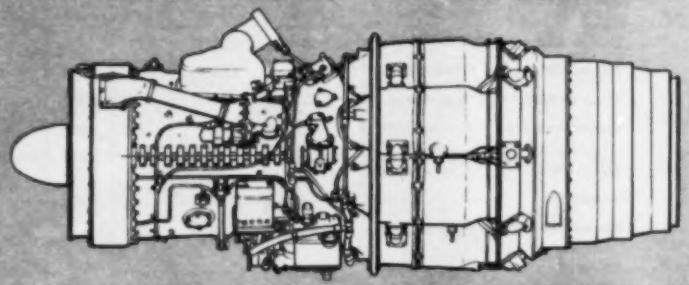
The second basic type to go into production was the RA.7, which started a 7,500 lb family of Avons in 1952. First of the "hot nose" Avons with full all-weather protection, the RA.7 type has a power/weight ratio even better than that of the original production series, in spite of the fact that the engine has been re-stressed to accept the loads imposed at transonic speeds. This type of engine is in large-scale production for fighters and bombers. A variant of the series, illustrated at the top of the page, is fitted with an afterburner of Rolls-Royce design, with a two-position nozzle, giving a re-heat thrust of 9,500 lb (27 per cent augmentation). An offshoot of this family is the civil 500-series, of which the Comet 2 engine is illustrated. Features of these civil Avons are the big ports for cabin-air bleed-off, the large electric starter, full all-weather protection, a Hardy-Spicer coupling flange for a remote gearbox, a high-energy ignition system (no torch igniter pipes can be seen) and synchronization equipment.

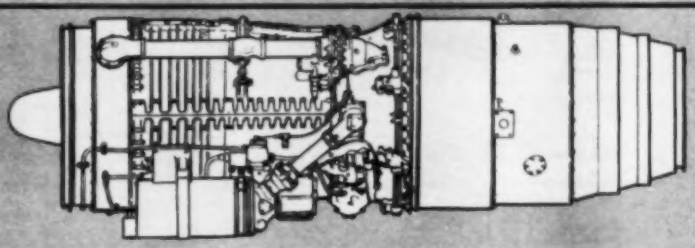
Progenitor of the finest series of Avons yet achieved is the RA.14, which first ran in 1952 and yet was being delivered in quantity last summer. This Avon family shows much redesign, and it incorporates all the experience gained in the period 1947-50 regarding blade and compressor theory and combustion systems. The RA.14 clearly has a longer compressor than have previous Avons, and also has a true annular combustion chamber, the latter being essential in order to accept the huge mass flow without increasing engine hoop diameter; actually, these latest Avons are slimmer, as the dimensions reveal. The RA.14 itself appears to be a wing-buried engine, owing to the fact that the accessories are mounted along the "corners." Later Avons are the Series 521 civil engine and the RA.28, both of which have type-tested thrust ratings of 10,000 lb. From the viewpoint of thrust per unit weight and thrust per unit frontal area, even the impressive performance of these late Avons has to give way before the little Rolls-Royce Soar, first announced in our previous issue. A simple-looking axial turbojet, the Soar has an annular chamber and a quite astonishing performance (see data). Already in production for a wide variety of applications, it marks the outcome of a huge amount of research and development in the Derby area, and the new engine will first be seen at next week's S.B.A.C. Flying Display and Exhibition. The existence has also been revealed of an entirely new type of power unit, the by-pass engine developed under the name Conway. Here, the excess air from an oversize low-pressure axial compressor is by-passed around the combustion chambers; the resulting engine has a far greater mass flow at a lower mean velocity than would a simple turbojet burning fuel at the same rate. Rolls-Royce have produced the Conway RCo.1, 2 and 3, and it may be assumed that the appropriate type of Conway will be available in a developed form when needed by the Vickers 1000 transport.



Rolls-Royce Avon RA.7R turbojet with afterburner. Axial compressor, eight combustion chambers. Diameter, 42.2in; overall length, about 276 in; dry weight, 2,960 lb; maximum thrust, 9,500 lb.

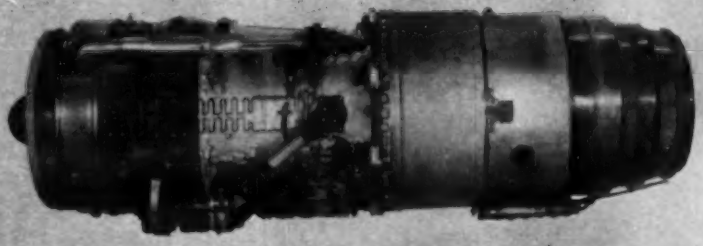
Rolls-Royce Avon 503 commercial turbojet. Axial compressor, eight combustion chambers. Diameter, 42.2in; length, 102.6in; dry weight, 2,242 lb; maximum thrust, 7,150 lb at 7,800 r.p.m. with s.f.c. of 0.89 lb/hr/lb.

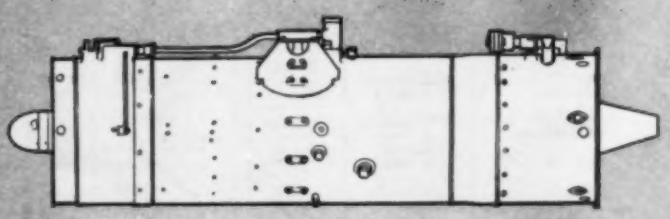




Rolls-Royce Avon RA.14 turbojet. Axial compressor and annular combustion chamber. Diameter, 41.5in; length, 113.3in; dry weight, 2,860 lb; maximum rated thrust, 9,500 lb with s.f.c. of 0.84 lb/hr/lb.

Rolls-Royce Avon 521 commercial turbojet at RA.26 rating. Axial compressor and annular combustion chamber. Diameter, 41.5in; overall length as shown, 113.3in; dry weight, 2,790 lb; maximum power, 10,000 lb type-tested dry thrust with specific fuel consumption of 0.86 lb/hr/lb.





Rolls-Royce Soar RSr.2 turbojet. Axial compressor and annular combustion chamber. Diameter, 15¼in; length as shown, 62¼in; dry weight, 267 lb (plus about 8 lb for intake); maximum power, 1,810 lb thrust with s.f.c. of 1.26 lb/hr/lb.

BRITISH POWER UNITS 1954

Maker's name and engine	Classification	Swept vol. (litres) or mass flow (lb/sec)	Max. boost (lb/sq in) or press. ratio	Max. take-off power				Typical cruising s.f.c.	Power/ weight ratio	Power/ Frontal area	Remarks
				s.h.p.	lb thrust	r.p.m.	s.f.c.				
ALVIS:											
Leonides 502/5 ...	P, 9r, air	11.78 l	8 lb/sq in	570	—	3,000	—	0.50	0.73	59.5	Typical fixed-wing Leonides.
Leonides 524/1 ...	P, 9r, air	11.78 l	7 lb/sq in	565	—	3,200	—	0.49	0.892	—	Helicopter engine. Crankshaft vertical, no reduction gearbox.
Leonides Major	P, 14r2, air	18.28 l	8 lb/sq in	870	—	3,000	—	0.50	0.757	106	Power plant for H.P.R.3.
Leonides Major	P, 14r2, air	18.28 l	—	—	—	—	—	—	—	—	Helicopter engine. Mount at any angle, no gearbox.
ARMSTRONG SIDDELEY:											
Double Mamba ASMD.3 ...	T, 2 (10a, Ann, 2t)	37 lb/sec	5.35:1	2,640	810	15,000	0.8	—	1.37	246	Two coupled power sections, with separate drives and controls.
Mamba ASM.3 ...	T, 10a, 6cc, 2t	18.5 lb/sec	5.35:1	1,320	405	15,000	0.8	—	1.89	321	Vaporizing burners. Single-shaft engine. Constant r.p.m.
Python ASP.3 ...	T, 14a, 11cc, 2t	52.5 lb/sec	5.35:1	3,670	1,180	8,000	0.805	—	1.20	260	Reverse-flow compressor. Single shaft. For Wyvern.
Sapphire ASSa.6	J, a, Ann, t	—	—	—	8,300	8,600	0.85	—	3.14	1,160	Vaporizing burners. Other types give much more power.
Snarler ASSn.1 ...	R, LO_2+WM	—	—	—	2,000	—	20	—	—	—	Development unit. Pump-fed propellents. Automatic control.
Viper 101 ...	J, 7a, Ann, 1t	31 lb/sec	—	—	1,640	13,400	1.09	—	3.51	410	In Midge and Jet Provost.
Viper ASV.6 ...	J, 7a, Ann, 1t	—	—	—	1,900	—	1.1	—	4.75	640	Short-life engine. Vaporizing combustion.
BLACKBURN CIRRUS:											
Bombardier 702	P, 4l, inv., air	6.524 l	—	200	—	2,600	—	0.45	0.565	52	Direct injection, much magnesium. Can run on automotive petrol.
Cirrus Minor 2A	P, 4l, inv., air	3.99 l	—	100	—	2,600	—	—	0.405	—	Stressed for racing. Stiffened top cover. 2,750 overspeed r.p.m.
Cirrus Major 3 ...	P, 4l, inv., air	6.3 l	—	158	—	2,450	—	0.48	0.448	46.4	
Palas	J, 1c, Ann, 1t	6.8 lb/sec	4:1	—	350	34,000	1.1	—	2.1	250	Data for basic Turbomeca design.
Palouste ...	GP,1c, Ann, 1t	6.6 lb/sec	3.8:1	1.9 lb air/sec		35,000	0.97	—	0.75	—	To be made by Blackburn in modified or redesigned, form. Palouste
Turmo	T, 1c, Ann, 1t	4.8 lb/sec	3.4:1	235	—	34,000	0.97	—	0.443	—	Power/wt based on figure of 140 h.p.
BRISTOL:											
BE.25	T,	—	—	—	—	—	—	—	—	—	Unconfirmed report. Two-spool. Power maintained at 4,000 h.p. to 20,000 ft; could give 8,000 at s.l.
Centaurus 173 ...	P, 18r2, air	53.6 l	—	2,850	—	2,800	—	0.42	0.838	171	In production for Beverley. Sleeve valves.
Hercules 738 ...	P, 14r2, air	38.7 l	13 lb/sq in	2,090	—	2,800	—	0.42	1.00	142	Sleeve valves.
Olympus B.OI.1	J, a+a, Cann, tt	—	—	—	9,750	—	0.766	—	2.77	1,140	Development engine. Two-spool. Cannular.
Orpheus ...	J,	—	—	—	—	—	—	—	—	—	For Gnat and other aircraft.
Proteus 733 ...	T, 12a+1c, 8cc, 4t	47	7.2:1	3,650	1,320	12,000	0.62	0.47	1.38	472	Free power turbine, reverse-flow compressor.
DE HAVILLAND:											
Gipsy Major 10/2	P, 4 l, inv., air	6.1 l	—	145	—	2,550	—	—	0.455	—	
Gipsy Major ...	P, 4 l, inv., air	—	—	200+	—	—	—	—	—	—	Direct fuel injection, development proceeding.
Gipsy Queen 30/2	P, 6 l, inv., air	10.2 l	—	250	—	2,500	—	0.51	0.476	55.5	Unsupercharged, ungeared, venturi carburettor.
Gipsy Queen 70/2	P, 6 l, inv., air	10.2 l	7.5 lb/sq in	380	—	3,000	—	0.46	0.526	84.4	Supercharged, geared, injection carburettor, made as engine-change unit.
Ghost 103 ...	J, 1c, 10cc, 1t	88 lb/sec	4.6:1	—	4,050	10,250	1.09	—	2.24	317	Later Ghosts give more power and are lighter. Bifurcated intake
Goblin 35 ...	J, 1c, 16cc, 1t	63 lb/sec	3.67:1	—	3,500	10,750	1.14	—	2.15	257.5	For Vampire Trainer.
Gyron DGy.1 ...	J, a,	—	—	—	—	—	—	—	—	—	Rugged and efficient engine for supersonic and other aircraft. Very great thrust.
Super Sprite ...	R, H_2O_2+hc. fuel	—	—	—	4,200	—	—	—	2.22	1,930	A.t.o. rocket. Power/wt. figure based on weight of complete pod (see p. 365).
FAIREY:											
Pressure jet ...	—	—	—	—	600	—	—	—	21.3	—	For helicopter tip-drive.
NAPIER:											
Eland	T, 10a, 6cc, 3t	31 lb/sec	7:1	2,690	825	12,500	0.697	0.475	1.925	431	Single shaft, upstream burners. Data for fixed-wing engine. Later versions more powerful.
Nomad	C, see remarks	13 lb/sec 41.1 litres	89 lb/sq in 31.5:1	3,046	320	2,050	0.345	0.327	0.877	165	Two-stroke diesel and gas turbine/compressor. Over 4,000 h.p. with reheat.
Oryx	GP, a, 5cc	—	—	750 gas h.p.		—	0.68	—	1.515	344	Fixed- and rotary-wing applications. S.f.c. is "lb/gas h.p./hr."
ROLLS-ROYCE:											
Avon 503 ...	J, a, 8cc, t	—	—	—	7,000	7,800	0.91	—	2.87	721	Civil engine. Elec. starter, bleeds and valves for pressure cabin.
Avon RA.7 ...	J, a, 8cc, t	—	—	—	7,500	7,800	0.92	—	3.05	771	Triple-breech starter.
Avon RA.7R ...	J, a, 8cc, t	—	—	—	9,500	7,800	—	—	3.2	977	With afterburner. Power/wt. includes weight of jet-pipe and shutters.
Avon RA.14 ...	J, a, Ann, t	—	—	—	9,500	—	0.84	—	3.32	1,009	First of new family with longer compressor and annular chamber.
Avon RA.21 ...	J, a, Ann, t	—	—	—	8,000	—	0.925	—	3.17	822	RA.7 descendant with annular chamber.
Avon 521 ...	J, a, Ann, t	—	—	—	10,000	—	0.86	—	3.58	1,063	Civil engine. Electric starter. Type-tested thrust.
Avon RA.28 ...	J, a, Ann, t	—	—	—	10,000	—	0.86	—	3.44	1,063	In production. Type-tested thrust.
Conway	BP,	—	—	—	—	—	—	—	—	—	By-pass engine. RCo. 1, 2 and 3 are running. For Vickers 1,000.
Dart 505 ...	T, 2c, 7cc, 2t	20 lb/sec	5.5:1	1,400	365	14,500	0.753	—	1.49	195	Two single-sided impellers on single shaft. Electrically heated intake.
Dart 510 ...	T, 2c, 7cc, 2t	20 lb/sec	5.5:1	1,550	365	14,500	0.705	—	1.53	214	In production for Viscount 700D.
Derwent 8 ...	J, 1c, 9cc, 1t	63.9 lb/sec	4:1	—	3,600	14,700	1.05	—	2.8	360	Has over 2½m hours in Meteor.
Griffon 57 ...	P, 12v, liquid	36.7 l	25 lb/sq in	2,455	—	2,750	—	0.42	1.175	311	Shackleton. Two-speed supercharger. Injection carburettor. Contraprop.
Merlin 35 ...	P, 12v, liquid	27 l	12 lb/sq in	1,280	—	3,000	—	0.44	0.84	171	Ballol. Single-stage, single-speed supercharger.
Merlin 724 ...	P, 12v, liquid	27 l	20.5 lb/sq in	1,760	—	3,000	—	0.45	0.99	220	Engine-change unit for Argonaut. Two-stage, two-speed supercharger.
Nene 10	J, 1c, 9cc, 1t	90 lb/sec	4.5:1	—	5,100	12,500	1.06	—	3.15	378	Made in U.K. and Canada for Silver Star. Electric starter.
Soar RSr.2 ...	J, a, Ann, t	—	—	—	1,810	—	1.26	—	6.78	1,326	Type-tested at 1,860 lb with different intake. Many applications.
SAUNDERS-ROE:											
Pulsejet	Flap-valves	—	—	—	45	—	—	—	2.9	214	For helicopter tip-drive applications.
Pulsejet	Flap-valves	—	—	—	120	—	—	—	—	171	

Notes: in col 2, P—piston engine, T—turboprop, J—turbojet, BP—by-pass turbojet, C—compound engine, GP—gas producer, R—rocket, c—centrifugal compressor, a—axial compressor, cc—combustion chambers, t—turbine stages, Ann or Cann—annular or cannular combustor, r—radial, l—in-line, v—vee-engine, inv.—inverted, LO_2—liquid oxygen, WM—water/methanol, H_2O_2—conc. hydrogen peroxide, hc.—hydrocarbon. All determinations of s.f.c. (specific fuel consumption), power/wt ratio and power/frontal area are based upon lb thrust, b.h.p. or total equivalent s.h.p., according to the type of engine considered.

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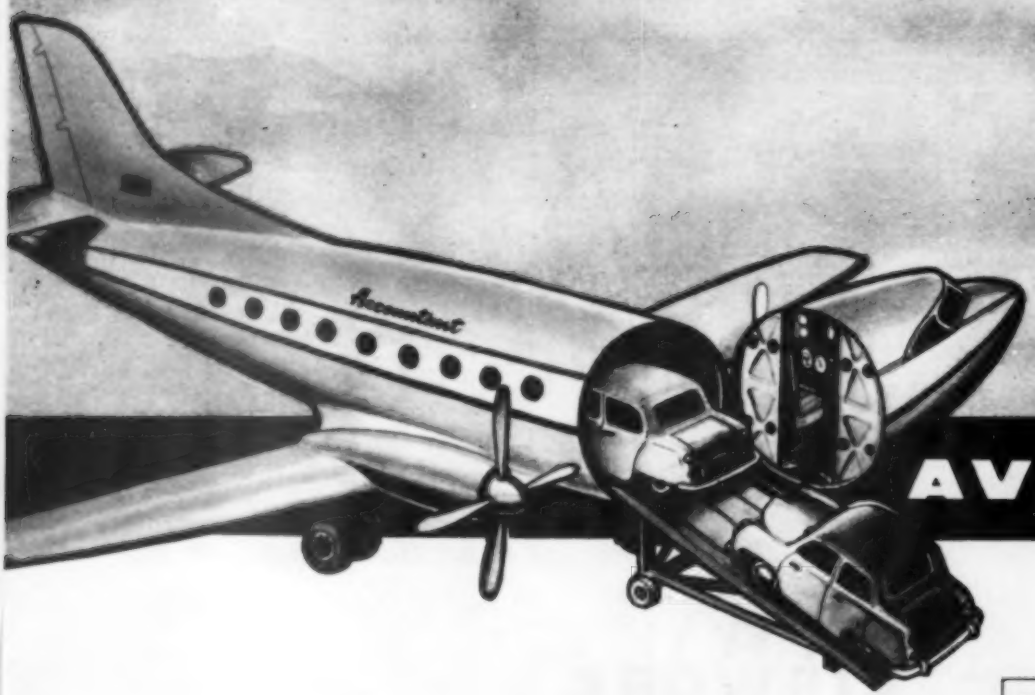

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ACCESSORY DEVELOPMENTS

TO a good many people, the harvest reaped each autumn at Farnborough is measured solely by the yield of new prototypes or test beds which flash noisily through the September sky. Some visitors to the Show venture inside the Big Top—for half-an-hour, perhaps, before the flying begins—and, if it is a "Public Day," they will there be gladly pushed and squeezed down limitless avenues of gleaming exhibition stands, on which are arranged so diverse a selection of highly technical products as to produce rapid mental indigestion of all but the most erudite or hardened intellects.

This year there are no fewer than 262 S.B.A.C. associate-member stands, in addition to the 19 large sites of the full members. Every one of the firms exhibiting, and hundreds more besides, will be found in the catalogue of the British Aircraft Industry which begins on page 378. It is this great body of enterprising companies which is the foundation of Great Britain's strength in the air. This country seems to have achieved a perfect balance between Governmental assistance, supervision and—if we may use the word—subsidy, on the one hand, and private endeavour, ability and desire to beat the next fellow.

All the developments outlined below and on the next four pages are products of this great and happy system, and each makes possible a parallel advance in the performance of one or more new British aircraft. Each of the new products described here will be available for inspection next week at Farnborough. And there will be other, even later developments, about which nothing may be published until the Display itself begins; we shall report upon these in our next two issues, September 10th and September 17th.

The Airscrew Co., and Jicwood, Ltd. (Stand 7), continue to produce a wide variety of aircraft fans and blowers (an air fan for the Victor was exhibited at the last S.B.A.C. Show), engine test fans, fixed- and variable-pitch airscrew blades, wind-tunnel impellers and blades, target-towing and crop-spraying windmills, wind tunnels and lightweight foamed plastics.

Automotive Products Co., Ltd. (Stand 208), have recently developed a new type of refuelling filter designed for efficient filtering of all types of hydrocarbon fuels at high flow rates, such as are needed by modern gas-turbine aircraft. There are eight Micronic plastic impregnated paper elements in the filter which has been prepared for display, and together they provide a filtering area of 17,600 sq in. This results in a rated capacity of 200 gal/min, but other sizes of filter can accept higher flows. The filter body can be dismantled without uncoupling the pipe-lines.

Boulton Paul Aircraft, Ltd. (Stand B), are in volume production with two main families of powered control system: fully powered units which are duplicated and/or operate split surfaces, and fully powered units which embody automatic reversion to manual control. A new development this year is a very compact unit suitable for mounting within the contour of a thin wing; a model has been made showing the unit in a wing of sonic section. A new valve-operated power control has also been developed for small aircraft.

British Messier, Ltd. (Stand 54), are manufacturers of such diverse undercarriages as those for the Britannia and the Midge. The former aircraft has two four-wheel main bogies and a hydraulically steerable nose undercarriage, the latter being fitted with two air volumes to reduce the severity of pitching reactions when the main-bogie wheel brakes are applied. The Midge has a simple tricycle undercarriage, with a castoring nose unit with twin wheels. All three units retract backwards into the fuselage, and the space limitations are such that each leg is arranged to telescope during retraction. Other Messier products include a booster flying control, which embodies a special valve gear, with pseudo-linear characteristics and neutral leakage, which, with a damping device in the main piston, provides great stability and sensitivity. A lightweight electrically operated poppet-valve selector for 4,000 lb/sq in hydraulic systems is another product, with actuation by a polarized relay instead of the usual four solenoids. Pump development includes the Type 4853 unit, driven by a Rotol electric motor, and similar to the standard Messier pump but operating on Skydrol 500 non-flam fluid.

de Havilland Propellers, Ltd. (The de Havilland Enterprise occupies Stand D). Unfortunately the greater proportion of the company's developments in the fields of guided weapons, missile systems and accessories, and even the latest developments in airscrews, cannot yet be made public. Guided weapons have, however, occupied a major part of the company's attention during the past two years, and much progress must have been made. The company's airscrew development is undertaken partly in conjunction with the Hamilton Standard division of United Aircraft, in an association of nearly 20 years' standing. New civil airscrews include high-efficiency, four-blade units of 10ft diameter designed for the Viscount airliner, and other airscrews cover the range 150 to 8,000 h.p. with both piston and turbine drive. D.H. turbine airscrews have some 50,000 hr development running to their credit, and the problems mastered include dead-beat governing, efficient reverse-pitch braking, automatic pitch locking and the manufacture of hollow steel blades on a production basis.

Delaney Gallay, Ltd. (Stand 200), have developed an already extensive range of fuel-cooled oil coolers, some being of the cross-counterflow type, and all being tailored to suit the requirements of high-speed turbine powered aircraft in which a high heat-release rate is required from a unit of modest dimensions. The latest product is a saddle-type oil cooler, cooled by the gas turbine fuel, entirely of light-alloy construction. Adaptable to a large variety of oil and fuel flow rates, this cooler is designed to fit closely around the casing of a gas turbine, and can be manufactured to suit whatever radius may be required.

The Dowty Group (Dowty Equipment, Ltd., Cheltenham, Stand 22. Dowty Seals, Ltd., Stand 23, Dowty Fuel Systems, Ltd., Stand 24, and Dowty Equipment of Canada, Ltd., Stand 25), are manufacturers of all kinds of landing gears, fuel system components, and electric and hydraulic equipment. The complete undercarriages prepared for display form include those for the Vulcan (main bogie), Javelin (main leg), Hawker Hunter (main leg) and Fokker S-14 (main leg) and Dowty of Canada have designed and made the complete twin-wheel undercarriage of the Avro Canada CF-100, which has also now been prepared as an exhibition model and brought to this country. Dowty Fuel Systems have developed the spill-type burner, in which ample energy is available at all altitudes to ensure good atomization, the excess being spilt back from the burner according to r.p.m. and altitude; such a system is used on the Ghost turbojet installed in some marks of Venom. Electric and electro-hydraulic apparatus includes a new stepless control, and magnetic eyeball indicators, in addition to the well-known Dowmic limit switch. Dowty seals continue to develop in all shapes and sizes in natural, synthetic and silicone rubbers.

Dunlop Rubber Co., Ltd., Aviation Division (Stand 151), have now prepared versions of the Maxaret anti-skid automatic brake control for both hydraulic operation and—a later development—for inclusion in high-pressure pneumatic systems. The company's 3,300 lb/sq in air compressor has now been taken to the Mk III standard, to cater for the needs of engine starters. It requires only 20 lb/sq in boost from the main engine compressor (instead of 30 lb/sq in, as in the Mk I) and has, therefore, a correspondingly higher altitude performance. Thus, when fitted to a typical Avon turbojet, sea-level output is maintained up to approximately 40,000ft. The free air delivery is 4 cu ft/min at a drive speed of 3,200 r.p.m. A new straight control handle for a pilot's control column has been developed, which incorporates a four-way switch for nose, tail and lateral trim, in addition to the usual gun and camera controls. The infinitely variable follow-up flap control has been further developed, and Dunlop ram and selector valves have been designed for a variety of additional applications, including new afterburner and engine temperature-control systems. The company's basic rubber products include many in silicone elastomers and other synthetic compounds, and new types of tyres (such as the dimpled tread pattern), wheels and brakes continue to appear.

Flight Refuelling, Ltd. (Stand 161). During the past year the Dorsetshire company have developed a complete "pack" unit, which is the outcome of the latest technique in the probe/drogue system of air-to-air refuelling. The pack comprises the hose reel, from which the drogue is trailed, and the tanks of transferable fuel as a single unit. It is wheeled to the aircraft (which can be a standard bomber) on a bomb trolley and then hoisted into the bomb bay and secured by pre-installed fittings. The feed arms are plugged into the aircraft electrical system to provide power for the hose-reel motor and the fuel pipes are connected to the tanker's existing piping to provide extra transfer fuel should this be required after the transfer tanks in the pack have been exhausted. Installation has been timed in

Accessory Developments...

the field at scarcely 30 minutes. The pack can be as readily removed; in fact, it makes the maintenance of a separate fleet of full-time tanker aircraft unnecessary. A sectioned model has been made showing how the pack is installed in a typical modern bomber. New fuel-system equipment includes the Mks 18 and 19 in-line refuelling valves and a water/methanol unit designed for the Viscount.

Electro-Hydraulics, Ltd. (Stand 16), are in volume production with several types of undercarriage, including main and nose legs for the Canberra, Swift, Pembroke and Shackleton 3. Other equipment includes camera-door actuators for Swift F.R.5s, and the company's most advanced undercarriage development remains the landing gear developed for the Victor, with twin steerable nosewheels and two eight-tyre main bogies. A new development this year is a high-temperature pneumatic system capable of operation at 400 deg C.

Godfrey RCU-1 Radar Cooling Unit.

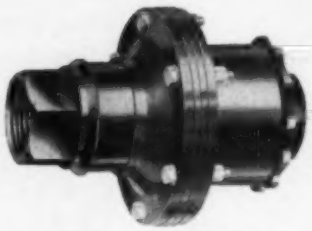
Sir George Godfrey and Partners, Ltd. (Stand 201). New airborne equipment includes the TF-5 turbo fan for ground-cooling a number of prototype military aircraft, the TF-10 lightweight turbo fan for the Britannia and Comet 3, WE-15 and WE-30 water extractors, both in military production, and a number of types of cold-air unit and cabin supercharger. An air-supply system for a ventilated suit has been designed, the air being tapped from the engine compressor and cooled in a heat exchanger in which the cooling medium is engine kerosine fuel. The air is then dried and passed through various valves before reaching the crew-member's suit. Several such systems have been flight tested. The item illustrated is a radar-cooling unit, which consists of a sealed package pressurized to 5 lb/sq in, containing an electrically driven fan which circulates air round the radar equipment and through the air/air heat exchanger visible on top of the unit. The Godfrey company have also produced various new types of cooling trolley, for both aircraft and ventilated suits, and a neat portable blower set for inflating aircraft lifting bags, delivering 25 cu ft/min at 5 lb/sq in.

Girling, Ltd. (Stand 149), have developed a new form of disc-type wheel brake for use on light aircraft. The principle is similar to that in use on some motor vehicles; in place of the drum and internally expanding shoes of the normal brake, a disc is gripped by friction pads in a caliper set astride the disc. Single or twin discs are used, floating on axial splines, and the friction pads are of segmental type mounted in diametrically opposed calipers—although, for light duty, a single caliper may be sufficient. In each case, an independent emergency operating system is provided, the main system being of either hydraulic or pneumatic type. Wear is automatically taken up by automatic adjustment incorporating the Girling Hydra-Static principle.

The Goodyear Tyre and Rubber Co. (Great Britain), Ltd. (Stand 141), now manufacture all their aeronautical products at their Wallasey, Cheshire, factory, with the exception of tyres, which continue to be made at Wolverhampton. During the past year further development in wheel brakes has taken place, and a new type of disc brake embodying a single annular piston is now in production. Known as the full circle brake, the new pattern is housed entirely within the wheel. It is standard equipment on the Viscount 720 (Trans-Australia Airlines) and 732 (Hunting-Clan). A further development of the full circle brake, employing dual discs but with a single annular piston, has been produced for the Vickers 1000 transport. Another very advanced brake is that now being made at Wallasey for the Republic F-84F Thunderstreak; entirely contained within the wheel without any projections, this assembly carries the wheel bearings around its periphery so that the wheel is, in effect, no more than a rim. Other types of Goodyear disc brake are in use on B.F.A. Pionair DC-3s and the Auster A.O.P.9, with four and one pistons respectively.

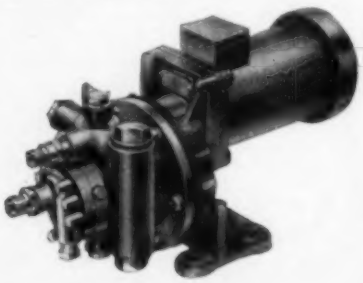
A completely different development is an anti-erosion cement for application to such surfaces as radomes and canopies, which are subject to wear from high-speed flight through rain. Covered by the M.o.S. specification D.T.D 856A, this cement is available in forms for either brushing or spraying.

H. M. Hobson, Ltd. (Stand 173), are now able to reveal a great many of their new components developed for such applications as powered control of high-speed aircraft and control of all kinds of power units, including ramjets and rockets. Unfortunately, very little can be said of these new units, although they can be publicly exhibited. Typical examples include the following: Powered flying control Mk 6 operates a jet-fighter tailplane and embodies a screw-jack operated by a duplicated hydraulic system; a built-in collapsible link device guards against a runaway condition caused by valve seizure. Powered flying control Type 163 has the same layout, and operates the tailplane of a high-speed all-weather fighter. Type 145 control actuates the all-moving tailplane of a lightweight jet fighter (clearly the Gnat) by means of an hydraulic screw jack, the electric trimming motor also being capable of use as an emergency actuator. The Mk 7 control operates jet-fighter ailerons by means of hydraulic pistons. Working models of all these units have been made. Other flying-control units are various rudder actuators, a heavy-bomber elevator unit with fully duplicated electric-hydraulic operation, and a feel simulator which applies suitable artificial forces to the control column of a powered-control aircraft and can also vary the stick/surface gearing according to the i.a.s. Hobson are also able to display, but not describe, two new items of ramjet equipment, ten new valves for rockets and five new gas-turbine items.



Hymatic valve Type RV22.

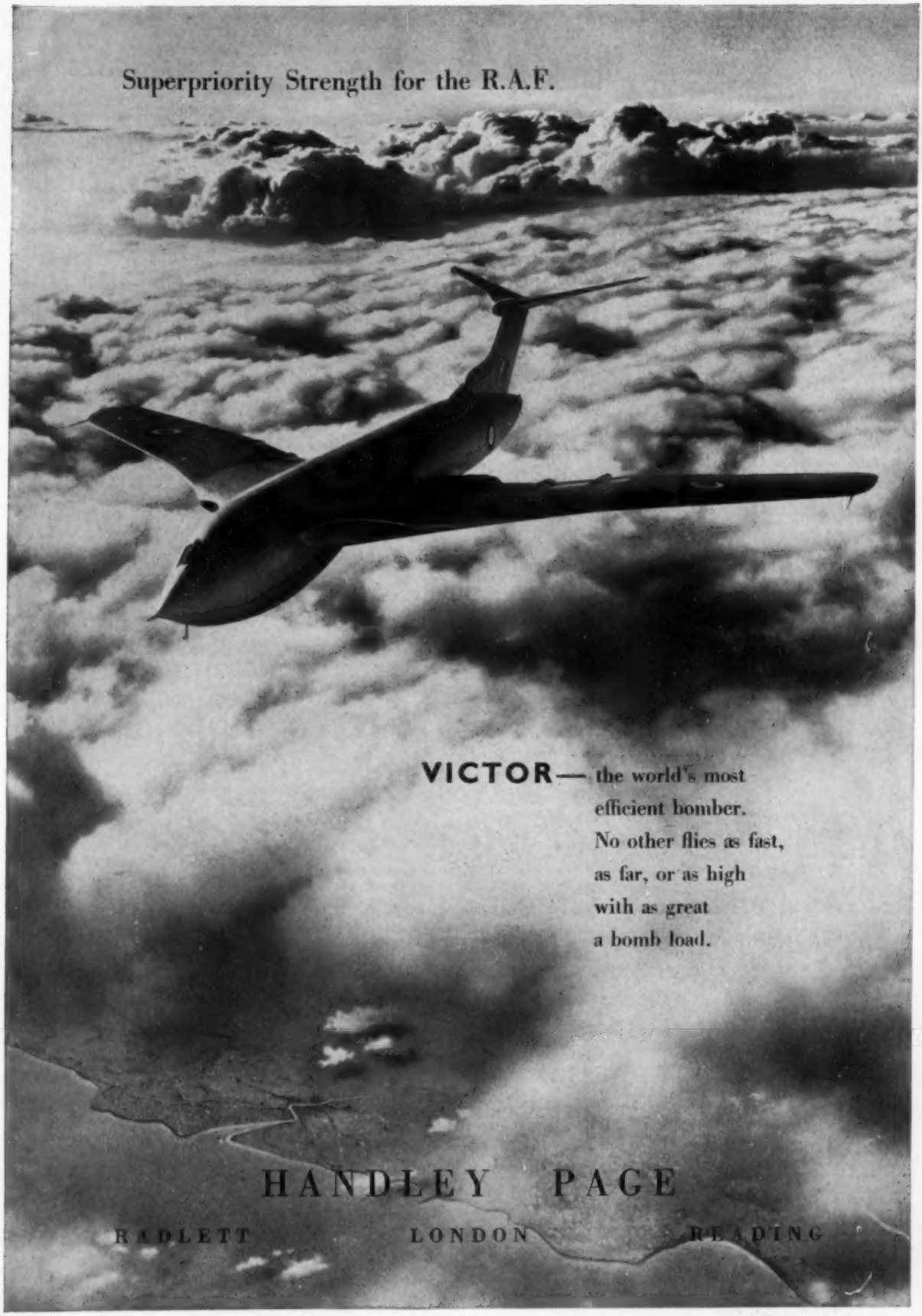
The Hymatic Engineering Co., Ltd. (Stand 182), are keeping abreast of aircraft designers' demands for more pneumatic power from ever-smaller equipment with a whole group of new valves and associated equipment. The most significant advance has been in improving the range of pressure-reducing valves; existing PS29 and 45 diaphragm types and PS48 hot-air series are now joined by the hot-air PS60/3, which incorporates a relief valve and is in production for the later marks of Swift; PS64, a nitrogen reducing valve; PS67, with built-in stop valve, on the Comet 3; high-pressure PS68, a nitrogen valve with input and output pressures of 4,000 and 2,000 lb/sq in, respectively; and PS69, an oil valve reducing 2,000 lb/sq in down to 1,000. Typical of the level of performance achieved is that of PS64: in two stages, it takes 1,800 lb/sq in down to a pressure of 10in of water and maintains a tolerance of ± 3in water for free-gas-flows up to 50 cu ft/min. The group is completed by a wide range of new or improved valves of other types. Of particular note are the RV inward venting and outward relief valves for fuel tanks. Rams and other pneumatic actuators are supplemented by various one-shot, pre-charged snap-jacks, which are now joined by a new one-shot stop valve, SV17, designed to release h.p. air to ancillary services in emergency. The valve is of the bursting-disc type, with an electrically fired detonator.



Integral motor/pump unit.

Integral, Ltd. (Stand 172). During the past year, the company have been developing a new line of products in the form of electronic fuel flowmeters, which are now to be publicly shown. Manufacture of these is about to begin. An accompanying illustration shows one of the latest Integral motor-pump units for powering hydraulic systems, the Type 148 Mk 1. Integral were also one of the first manufacturers to obtain a hydraulic pump officially type-tested on non-flam hydraulic fluids, such as E.E.L.6.

Kelvin and Hughes, Ltd. (Stand 3). Further work has been undertaken on two types of stall-warning indicator, one being dependent upon the pressure ratio between the pitot head and a point on the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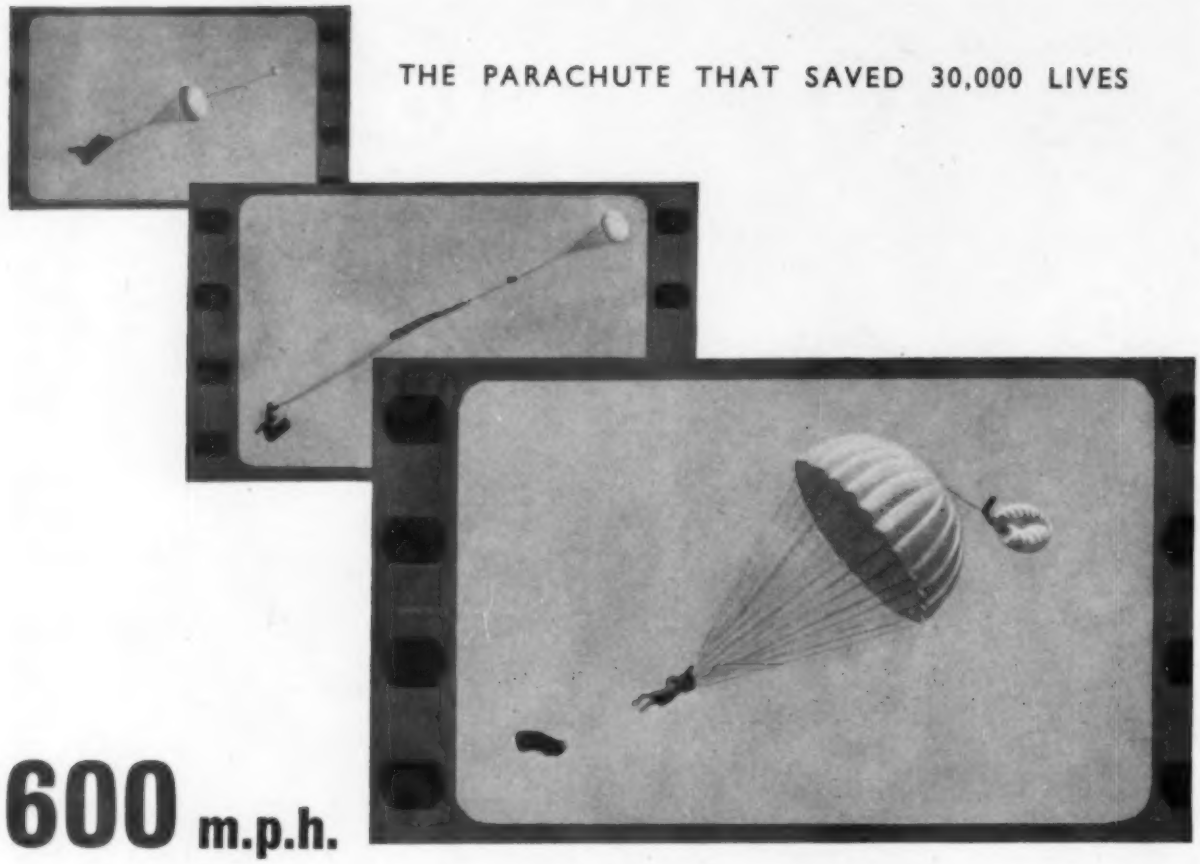

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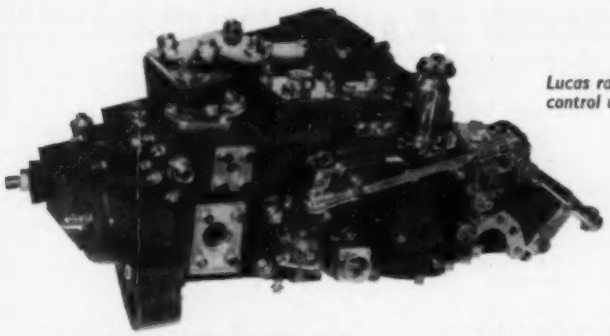


Lucas range temperature control unit.

Accessory Developments...

Kelvin Hughes resolver indicator.

underside of the wing and the other being governed by the position of a small tab, spring-loaded against the airstream, mounted above the wing at about 90 per cent chord. The combined i.a.s. and Mach switch is an instrument which provides a warning at a calibrated value of indicated airspeed or Mach number, and operates with great accuracy up to sonic speed and an altitude of 60,000ft. A new tachometer system comprises a three-phase stator and permanent-magnet rotor driving a synchronous motor and drag cup indicator, the latter being calibrated in percent of nominal maximum r.p.m. The indicator is designed to synchronize at a very low speed, and is filled with an inert gas and sealed; the generator is designed for direct mounting and can run at extremely high temperatures in contact with engine oil (including synthetic lubricants). Other new items are a three-pointer sensitive altimeter calibrated up to 80,000ft, an illuminated version of the E2A compass, a transonic Machmeter and a new addition to the GM2 compass system, known as a resolver indicator, which produces strong synchronous signals electrically isolated from the basic servo system. Its design has been necessitated by the increasing use of navigational aids which require heading information; it is illustrated.

K.L.G. Sparking Plugs, Ltd. (Stand 4), are another company of the Smiths Group. During the past year they have announced the development of Hylumina, a new ceramic insulant, now incorporated in a wide range of K.L.G. products. A thermocouple harness, for example, employs the new ceramic to insulate the wires in the stagnation sheath, which must withstand at least 800 deg C. In these K.L.G. harnesses the conduit is made of stainless steel, and the harness leads are insulated with silicone rubber. The thermocouples themselves incorporate p.t.f.e. high-temperature insulating material for the chromel and alumel leads; Type H.16/26 is a K.L.G. pattern for installation in all new aircraft designs, and it has five-foot leads insulated with p.t.f.e., a vitreous head seal and Hylumina within the stagnation sheath. Two advances, of revolutionary character, have been made in ignition harnesses. The first is a tubular ceramic extension for conveying h.t. or high-energy power to the igniter from a point beyond the intensely hot zone; the second is a thin-wall elbow with a strong vitreous film insulation for use with high-energy systems, the plug being integral with the elbow.

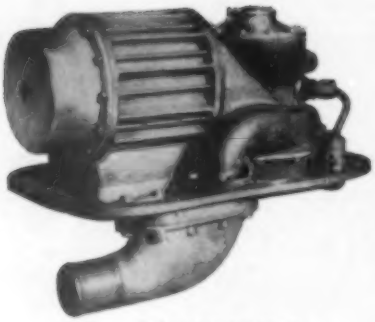
The Lockheed Hydraulic Brake Co., Ltd. (Stand 209), have developed a self-contained hydraulic power pack. It consists of a hand pump, selector, jack and reservoir, and it is intended for applications demanding rather more than can be reasonably provided by manual power in aircraft having no hydraulic system; a typical example is the flap-actuation of the Auster A.O.P.9. This compact pack weighs 4¼ lb complete with handle, and was designed to give a 750 lb effort for 20 lb handle load; in this application, four full strokes of the handle result in full travel of the jack of 2.1in. The valve is so arranged that the flap can be inched down, remains locked in any intermediate position and can blow back gradually if overloaded. Other well-known Lockheed products include undercarriage legs for such aircraft as the Vampires and Venoms, Beverley and Avro 707s, and nose-wheel steering units, of which an example is shown. Servodyne powered flying controls remain in full production, and further work has been done in the development of reliable hydraulic systems employing non-flam fluids. A new silent cut-out valve has also been developed, which eliminates "hammer" in a 2,000 lb/sq in system (2,550 max) at 12 gal/min flow rate.

Lockheed nosewheel steering unit.

Joseph Lucas (Gas Turbine Equipment), Ltd. (Stand 137), continue to be one of the world's principal designing and manufacturing firms for all types of combustion equipment. Gas turbine fuel systems can now be rapidly developed for high-, medium- and low-altitude requirements for turbojets and turboprops. The chief factor in the design of fuel pumps is an incessant cry for more output, and the present Lucas range (450 to 2,500 gal/hr) is now having to be supplemented by even larger units giving very much greater delivery. Kinetic servo valves are replacing ball valves on some pumps; the kinetic orifice is less sensitive to foreign matter in the fuel and the mechanism is not pressure-conscious and, therefore, gives a better response characteristic. Two new principles of fuel-pump governor are now being produced, which are insensitive to variation in fuel density and various other disturbing factors. The first governor, known as the density compensator, applies a bias pressure against the normal centrifugal pressure component of the governor, the bias being responsive to the variation in viscosity accompanying changes in density of the fuel; this governor is being fitted to some smaller pumps. The second system, known as the hydro-mechanical governor, is fitted to larger pumps, and provides a hydraulic reference pressure sensitive to engine speed and independent of any variable factors such as fuel quality. The range temperature control unit (illustrated) meters fuel to the engine by controlling a small by-pass flow related to ram pressure. It is a composite unit incorporating a proportional flow control, acceleration control, speed and temperature trims and other controls.

Normalair pressure controller.

Normalair, Ltd. (Stand 62), have extended their licence agreement with the American AiResearch company to include refrigeration turbines and a pneumatic temperature control which obviates the need for any electrical components and results in a simple mechanical unit with very low weight and bulk. Another agreement has been reached with the Eclipse-Pioneer division of Bendix for the licence-production of liquid-oxygen converters. These consist of vacuum containers charged with liquid oxygen which is evaporated in a controlled manner to pass a constant supply of gaseous oxygen into the aircraft system. Foremost among the new items of Normalair design is a completely new range of flow-control equipment, including an automatic flow controller, a high-pressure mass flow controller and a diaphragm-type



Pulsometer fuel booster pump.

Accessory Developments...

control valve. Other new products include the Type E pressure controller (length 5in, weight 1.27 lb), a universal non-return valve, a flow equalizer, two wholly new mixing valves, a venturi humidifier and a variety of new developments in demand oxygen systems.

The Palmer Tyre, Ltd. (Stand 158), have, since last year, refined and simplified their new differential rudder-bar brake control, and have incorporated pilots' and contractors' suggestions for increased comfort during long flying periods. A unique feature is stated to be the manner in which the pressure feedback keeps the pilot continuously aware of the degree of braking he is applying to either wheel. The equipment has been selected for the production Jet Provost.

Plessey pump suitable for missiles.

The Plessey Co., Ltd. (Stands 238, 239 and 240 are occupied by the Plessey Group). New developments have been made in each of the many fields covered by Plessey, Plessey International and the Wireless Telephone company. A new controller has been prepared to maintain the temperature of an electrically heated windscreen within ± 5 deg C of the desired temperature, magnetic amplifiers being used to provide normal control, preheating from low temperatures and a separate emergency control to limit the windscreen temperature to below 70 deg C. A new type of flasher unit for aircraft navigation lights is controlled electromagnetically (nominal 24V) to the flashing rate and contact sequence laid down by the M.o.S. or A.R.B. A new v.h.f. aerial multicoupler has been developed, which not only permits six receivers to be operated from one aerial but also provides an insertion gain of 17 db with a noise factor of 8 db. An electronic precision tachometer is another recent product, which counts electrical pulses generated by the rotation of a shaft during one second and presents the result visually in terms of r.p.m., with an accuracy of 0.1 per cent, or as low as 0.03 per cent at high r.p.m. Several new actuators include the Plessey Leopard which, with a working load between 350 and 900 lb, has a stroke of no less than 18½in. Many new types of hydraulic pump have been developed, including an electrically driven hydraulic power pack, a gear pump for non-inflammable fluids, pumps for windscreen deicing and pumps for guided weapons, one of the latter being illustrated.

The Pulsometer Engineering Co., Ltd. (Not exhibiting at Farnborough). The Reading company have continued development of various fuel pumps during the year, and have now designed the booster pump illustrated. Intended for mounting directly to the bottom of the aircraft tank, the output is no less than 2,000 gal/hr at 11 lb/sq in.

Rotax, Ltd. (Stand 138) It is regrettable that nearly all the company's advances during the past year are security-restricted. In the aspect of electric equipment, the company have made great efforts to standardize switchgear, alternators and generators, actuators and starters, so that all requirements can be met by a limited range of products. In generating equipment, for example, five units cover the range 150 W to 22½ kW D.C. and four cover A.C. outputs between 7.5 and 75 kVA. All these machines have been designed to run over a wide speed range; if a constant-speed drive were employed—say, at 8,000 r.p.m.—then the 75 kVA alternator could be modified to provide about 140 kVA. A new D.C. generator has now been developed with a 6 kW output at 28 V over a speed range 2,860 to 10,000 r.p.m. Invertors and rotary transformers, and their control panels, have been further developed, together with all forms of high-power aircraft switchgear. The Rotax fuel/air starter is now in full production at Willesden, with a torque output rated at 100 lb-ft at 1,400 r.p.m. and 130 lb-ft at zero r.p.m. Rotax electric actuators are being increasingly used in all forms of flying-control circuits, such as those for ailerons, tail incidence, trimming and flap actuation; a 112-volt wing flap actuator is illustrated, this pattern having twin motors and a differential gearbox.

Rotol, Ltd. (Stand 53), are now able to reveal several major developments. Among airscrews, one of the most important is the new four-blade single-rotation unit developed for the Series 800 Viscount. This airscrew has high-efficiency blades with exceptionally wide chord, and it is equipped for synchronization. Rotol also manufacture the Viscount airscrew controller and feathering pump. Two new accessory gearboxes—one of the company's most important lines of development—are those for the Armstrong Siddeley Mamba turboprop and Sapphire turbojet, respectively. The former installation consists of two identical gearboxes, each of which provides a drive for a 30 kVA alternator, a 9 kW generator, a vacuum pump and a Messier hydraulic pump. The latter box is clearly intended for an aircraft with two Sapphires, for it is mounted between the engines and is driven through freewheel units so that the drive may be taken from either Sapphire. The box drives three hydraulic pumps and two 9 kW generators. Other new equipment includes a feathering relay switch, the Rotol fuel-flow proportioner, and the ram-air turbine and air-turbine accessory-drive equipment which the company are producing in association with AiResearch. A new electric motor has also been fully developed to drive the British Messier hydraulic pump which operates the Britannia landing gear. This motor runs at 10,800 r.p.m. off a 208-volt system, and can be mounted in regions of high temperature.

Saunders Valve Co., Ltd. (Stand 142), have, as well as progressively developing both the design and production methods of their spherical plug and taper plug cocks and gate valves, produced several new components for handling a variety of airborne fluids. Taper plug cocks with aluminium body and bronze liner have been developed for aircraft, and laboratory models are being produced with a bronze body. These are available in 2, 3, 4 and 5-way patterns, with various limb and port arrangements. In spherical plug form, new valves are now being made in sizes from ¼in to 4in bore, and they are considerably lighter than earlier patterns. The range extends to multiway types and metallized versions for use with hot air and liquids. Thermal relief is an inherent feature of the spherical plug form, owing to the seat diaphragm. These cocks can also be arranged to act as shut-off cocks at a given pressure and to relieve at a higher pressure.

Self-Priming Pump and Engineering Co., Ltd. (Stand 65), have a very large range of fuel tank booster pumps for all kinds of military and naval aircraft, including the Canberra, Gannet and French Mystère 4. The pump illustrated is the SPE 1607, which marks a complete break-away from previous practice. This pump has a very neat impeller, and

Rotax 112-volt flap actuator with differential box and twin motors.

THE ANSWER TO EUROPE'S AIR DEFENCE PROBLEM

Trends that were unchecked for forty years so increased the size, weight and cost of the standard fighter and the difficulties of its design, production and operation, that few countries have the resources to build or buy the fighters they need for their defence. A halt has now been called, and a new trend started by the Folland Gnat, a light jet fighter with a flying and fighting performance that meets the sternest demands of modern war and provides the answer to Europe's air defence problem.

The following comparisons with the standard fighter illustrate some of the more significant merits of this new type of aircraft.

● MAN-HOURS
Tooling time for production is halved, and twenty-five light fighters instead of five standard fighters can be built in the same number of airframe man-hours.

● COST
Twenty light fighters, fitted with all essential flying, navigational and armament equipment, can be built for the price of six standard fighters.

● FIRE-POWER
The five light fighters produced in the time needed for one standard fighter can bring to bear 10 × 30-mm. cannon instead of the 4 × 30-mm. cannon, or 6 × 0·5-in. machine-guns of the standard fighter.

● HANDLING
With its high thrust-weight ratio, powered controls, and low lateral inertia, the light fighter will have outstanding manœuvrability. Pilots can learn to fly it in less time because of its simplicity and handiness.

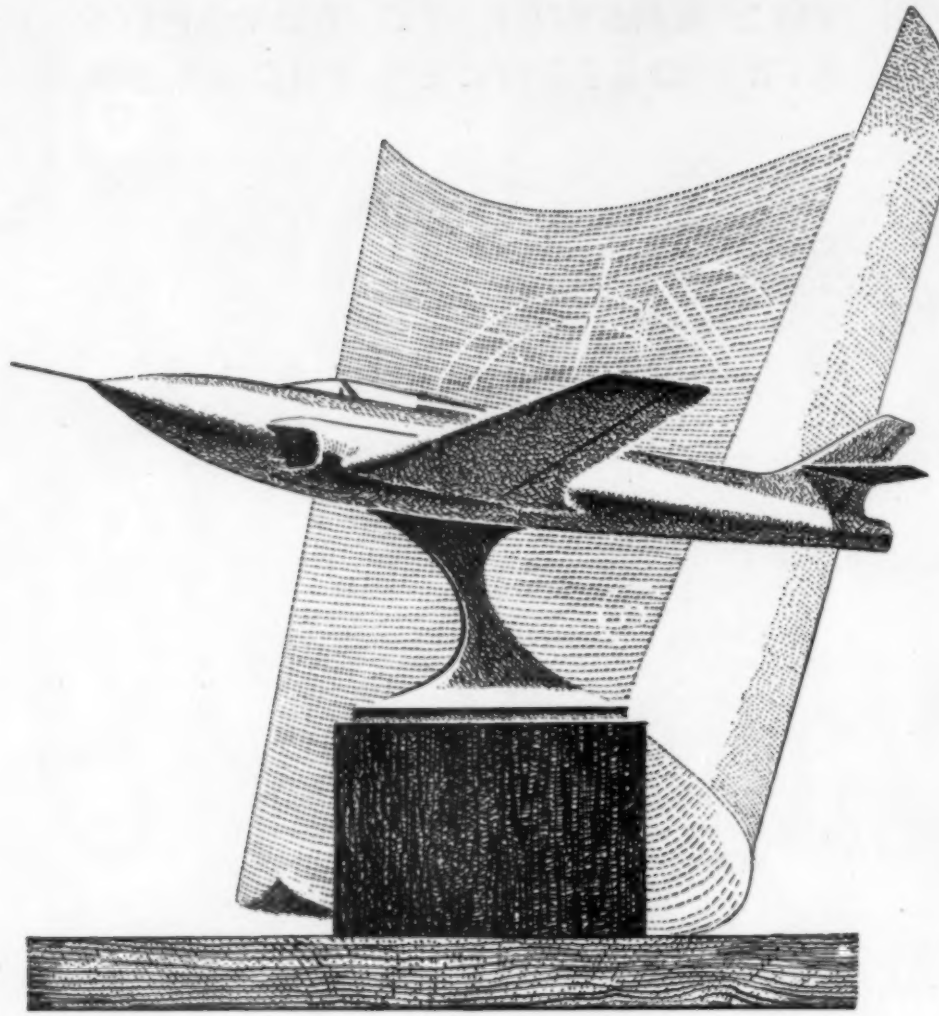
● SERVICING
The simplicity of aircraft services and the smaller amount of equipment installed cut servicing time and increase operational strength. All items needing routine attention are sited where they can be reached without trestles or staging.

● MOBILITY
Light fighters can be carried by air freighter, ship or lorry with little or no dismantling, and can be given ample flight duration for ferrying by the use of long-range tanks.

The Gnat was designed and built as a private venture by

FOLLAND AIRCRAFT LIMITED

HAMBLE • SOUTHAMPTON • HAMPSHIRE



Serving those who look ahead . . . .

We will be very pleased to welcome visitors who attend Farnborough at Stand 31. We are proud to have been associated with the development of many of the major advances in design and construction embodied in the aircraft which are being demonstrated to the world.

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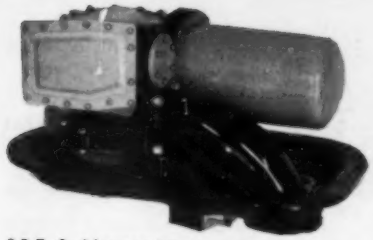
H.1

Accessory Developments...



S.P.E. fuel booster pump.

delivers up to 1,600 gal/hr off a 24-volt system. It can be mounted either on the bottom or side of the tank, and is already flying in a supersonic fighter.

Serck Radiators, Ltd. (Not exhibiting at Farnborough). Illustrated below is the fuel/oil heat exchanger used on the Olympus Canberra. Made entirely of light alloy, it is installed in the h.p. fuel supply—which is not subject to vapour locking at high altitude—and is therefore of robust construction, and incorporates special sealing. The cooler stack can expand longitudinally and the symmetrical radial oil flows and concentric annular fuel flows are so arranged as to offer very high performance without stress, and while maintaining very low overall dimensions. Other Serck units include fuel heaters to prevent filter icing, heated by compressor-bleed air, and a new range of very light air/oil coolers for helicopters.

Serck fuel-cooled oil cooler.

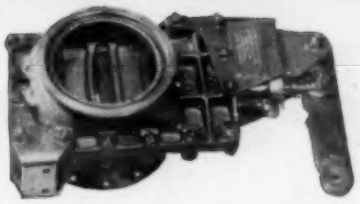
Simmonds Aerocessories, Ltd. (Stand 170), continue to develop the widely-used Pacitor electronic fuel gauge, of which models are available reading directly in mass or in volume, with a circuit which compensates for the variation in the dielectric constant of the fuel. The latest Pacitor systems are considerably lighter than previous patterns. The Simmonds flowmeter utilizes a new principle, and combines ease of installation with low weight; both rate of flow and total flow passed can be indicated, and several flows can, if necessary, be summated. The specific gravity meter gives a remote indication on a meter scale and will operate off any power supply. It is insensitive to variation in supply voltage.

Smiths Aircraft Instruments, Ltd. (Stand 2), have developed a twin-compass installation for transport aircraft, comprising port and starboard gyro-magnetic systems, each consisting of a remote gyro, detector unit, amplifier, heading indicator and annunciator unit. If the two systems cease to remain in alignment, a warning light is actuated, and the annunciator can then be consulted to determine which system is giving a false reading. Either system can be coupled to an autopilot and Flight Director. Smiths have also prepared an air-driven artificial horizon with adjustable roll and pitch datum indices, making it specially suitable for installation in helicopters. Development of the S.E.P.2 autopilot continues, and the installation is in production for the Comet 2 and 3, Britannia and late-model Viscounts.

The Sperry Gyroscope Co., Ltd. (Stand 124), have developed a new integrated flight instrument system which provides azimuth and attitude information on standard 3½-in-diameter repeater instruments operated by azimuth and vertical gyros mounted in other parts of the aircraft. Known as the Duplex Flight Data system, the installation provides the captain and first officer with identical sets of instruments independently monitored by entirely separate systems. Full provision is made for monitoring, in azimuth, such additional equipment as autopilots, flight directors, radio-magnetic indicators and v.o.r. systems. Such an installation will be very valuable to crews of fast transports and other aircraft which have to conform to a closely defined cruise control. Other new Sperry products include the HL8 air-driven horizon with complete freedom in roll and yaw and 170 deg freedom in pitch, and a new type of HL4 helicopter horizon, with improved presentation (illustrated).

Sperry horizon for helicopters.

Teddington Controls, Ltd. (Stand 45), have long recognized the shortcomings of electrical control systems for cabin temperature, and a wholly pneumatic system has now been developed using the existing high-pressure engine tappings as a power source. The unit exists as a proportional controller utilizing an integral follow-up. It is separate from the pneumatically actuated control valves and can, therefore, be used to govern various other valves such as those in surface de-icing circuits; further work also suggests that it will be widely used without the temperature-sensitive element as a pneumatic mass-flow control. Among new actuators developed by the company are single- and two-speed units, and a twin-motor two-speed actuator arranged as a sealed unit with "twin-engined safety." A cabin-temperature control in which magnetic



Teddington carbon gate-valve.

amplifiers replace thermionic valves entirely is another development for military aircraft, and further developments have been made with time and cycling switches, intervalometers, navigation-light flasher units and gas turbine re-heat control switches. One of a range of carbon gate valves is illustrated, these being units capable of operation with through-air temperatures of up to 320 deg C for controlling exhaust-gas systems for anti-icing, and other purposes; the actual unit illustrated is one of a special very-high temperature range, with a Ni-resist cast body and sliding valve actuated remotely, and the operating conditions include a through-air temperature ranging from −55 to +720 deg C at a pressure of 30 lb/sq in. It weighs 8½ lb.

Teleflex Products, Ltd. (Stand 217), have recently concluded an agreement with the Pacific Scientific company, of San Francisco, which makes them sole British Commonwealth licencees for the American company's cable tension regulators. Hitherto it has been the usual practice for British aircraft manufacturers to employ rods or tubes to carry engine or flying control movements, while corresponding American firms use cables. The main objection to cables is, in large aircraft at least, the fact that the cable (generally of steel) does not respond to temperature change at the same rate as does the airframe. With the American company's tension regulators, a system of springs and brakes can be built into the system to provide a circuit which is permanently snug and free from backlash. Teleflex have a demonstration rig showing the system as used on the Boeing B-47, and it has sectioned fittings which show the principle of the mechanism.

Waymouth Gauges and Instruments, Ltd. (Stand 1). A member of the Smiths Group, Waymouth produce both their well-known capacitance-type fuel-contents system and also the Smith Liquidometer fuel contents gauge. The latter incorporates a reference unit which is immersed in the aircraft tank and determines the density of the fuel and takes into account the empirical relationship between this factor and the fuel dielectric constant. The connections between the tank units and the amplifier are made by small-diameter p.t.f.e. cables, very resistant to high temperatures, coupled to B.N.C. connectors so arranged as to prevent mis-matching. Development of Waymouth gas-turbine temperature control systems has proceeded, and a wide range of similar systems is now available. These ensure that the gas temperature is maintained at the maximum level for acceptable turbine blade life.

Westinghouse Brake and Signal Co., Ltd. (Stand 15), are progressively increasing the output/weight ratio of their range of Westalite airborne rectifier equipment. The company can now show their latest extra lightweight rectifier, and other selenium and copper oxide rectifier units have been developed for radio, radar, instrument and other circuits. There are also various types of miniature selenium units for e.h.t. circuits, including some hermetically sealed for tropical use, and a range of germanium crystal diodes.

Going to the Show

Routes and Admission Charges

THE 1954 Flying Display and Exhibition of the Society of British Aircraft Constructors will be held at Farnborough from next Monday, September 6th, to Sunday the 12th.

As was the case last year, Monday will be a Press and technicians' preview. Tuesday, Wednesday and Thursday are guest days, and the public are admitted only on the last three days.

On these public days the gates open at 10 a.m. and close at 7 p.m. Flying begins at 3 p.m. Tickets for Friday only can be obtained in advance from Autoparks, Ltd., 1 Maclise Road, Olympia, London, W.14, or through agencies. Tickets for this day can also be obtained at the gate. Tickets for Saturday and Sunday will be on sale only at the gate.

Prices of admission on the Friday (public première) are: adults £1, children 10s, plus parking fees of £1 for private cars, £1 for buses and coaches, 5s for motor cycles and 2s 6d for pedal cycles. On the Saturday and Sunday the charges are: adults 5s, children 2s 6d, and private cars *inclusive* of occupants £1 10s. Parking fees for coaches, motor cycles and pedal cycles are 10s, 2s 6d, and 1s respectively. Except in the case of private cars on the Saturday and Sunday, the charges for vehicles are parking fees only and admission to the display is extra.

The S.B.A.C. has issued the following route guidance for motorists going to Farnborough on the three public days:—

From the North: From Oxford follow A423 to Wallingford, there joining A329 to Reading. Then take A327 to Eversley and follow R.A.C. signs.

From Exeter, Bristol and Gloucester: To Basingstoke, then follow A30 to Dorchester Arms Public House, fork right to Odiham and follow R.A.C. signs.

From Portsmouth: A3 to Petersfield; at Sheet, turn left to A325 and on through Liss, Greatham, Bordon and Farnham. Follow R.A.C. signs from Farnham.

From Maidstone: Along A20, then fork left to A25 through Ightham, Westerham, Oxted, Godstone, Redhill, Reigate and Dorking to Guildford by-pass. Then follow R.A.C. signs.

From London (strongly recommended): Putney Bridge to Kingston by-pass to Esher, then follow A3 to Cobham, Ripley and Guildford. Turn right at Guildford by-pass and follow R.A.C. signs.

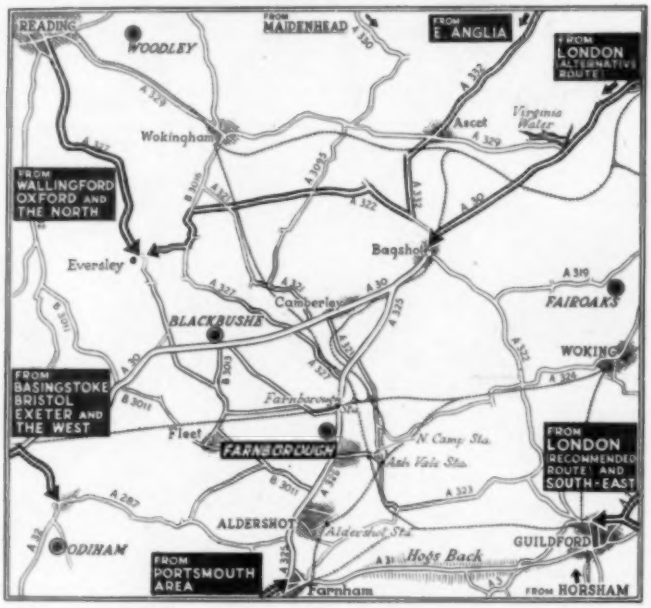
From London (alternative): Hyde Park Corner to Knightsbridge, Hammersmith and first roundabout on Great West Road. Turn left along A30 to Staines, Egham, Sunningdale and Bagshot, then follow R.A.C. signs.

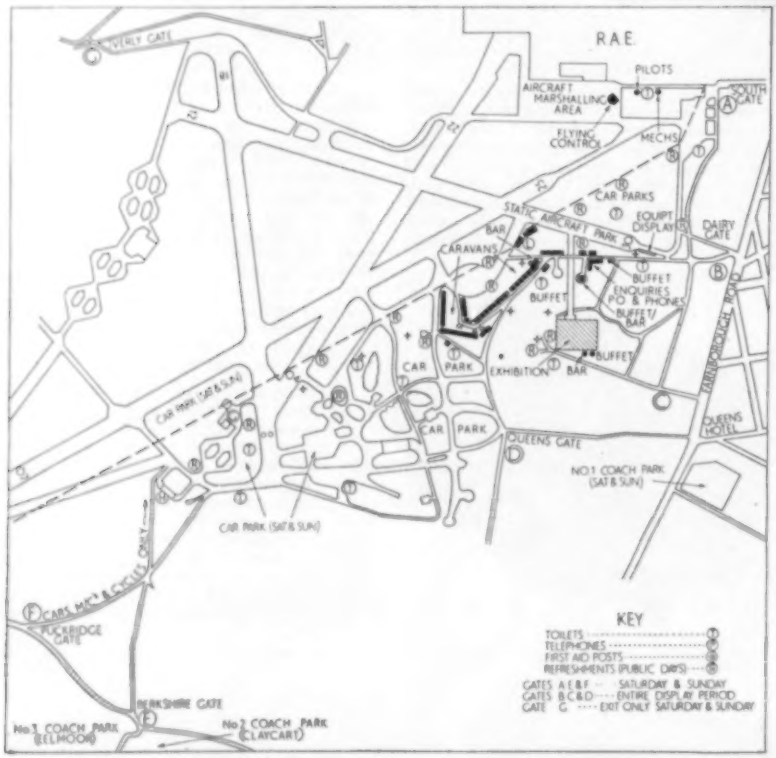
From East Anglia: Follow A412 from Watford to Slough. Then A332 through Windsor and Ascot. Turn right on to A322 and then left along Nine Mile Ride to Finchampstead, then to Eversley and follow R.A.C. signs. [This is a route additional to those of last year. The right turn on to A322 is an acute one just short of Bagshot.]

As regards transport facilities on the public days, the Aldershot and District Traction Co. will have high-frequency bus services between Aldershot and the airfield and between the Farnborough main railway station and Farnborough North railway station and the airfield. There is also a service between North Camp railway station and the airfield.

The company's regular half-hourly express coach service between London (Victoria coach station) and Farnham passes the airfield. Intending passengers on this service are advised to book their seats in advance.

On the three public days, also, additional facilities will be provided in conjunction with British Railways, Southern Region. The bus company will operate a special bus service between Aldershot railway station and Farnborough in conjunction with the augmented railway service between Waterloo and London. Trains will also run to North Camp railway station, and from that point a special bus service is operated by the Aldershot Traction Company. There will be combined rail and road cheap day tickets to Aldershot from Waterloo and many Southern Region stations in the outer London area. On the Saturday and Sunday restaurant-car excursions will be run from Brighton to North Camp.





Roads in the Farnborough area, showing recommended approach routes. R.A.C. signs are followed onwards from the large arrow-endings. (Left) Arrangement of the enclosures and car-parking facilities at the airfield. Entrances for the various days are shown.

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This aircraft testing rig can be arranged to give varying air pressures from 200 lbs.□" upwards, or a controlled flow of air for special requirements. Every servicing need can be met by this one unit.

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Electric starting and lighting equipment.

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IN THE FARNBOROUGH EXHIBITION HALL

AS a guide to the Exhibition Hall at Farnborough, we print below a plan of the floor, together with an index of exhibiting firms. The record number of 280 firms which are exhibiting is an increase of 36 over last year's total. The picture of the aircraft industry's constituent firms is completed by the directory overleaf, in which the names, addresses and principal products of over 400 companies are given. Details of the products of the main aircraft and engine manufacturers appear in the earlier sections "British Aircraft 1954" and "British Engines 1954," and those of a number of manufacturers of major items of equipment in the "Accessory Developments" section. Data on the activities of the majority of firms contributing to the industry are therefore available under at least one of these headings.

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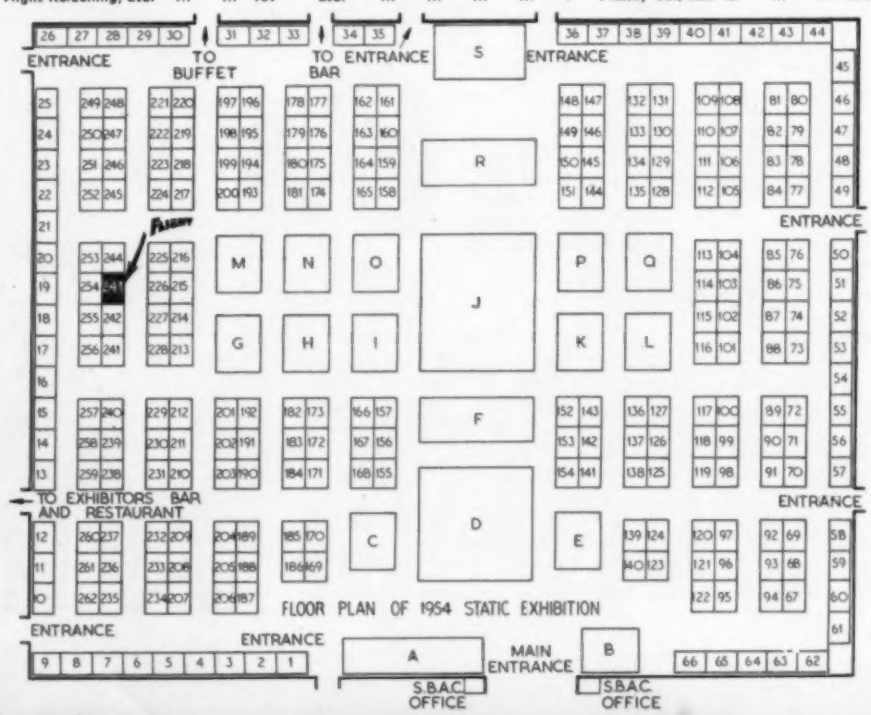

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AIRCRAFT

AIRSPEED.—See de Havilland Aircraft Co., Ltd.

ARMSTRONG WHITWORTH AIRCRAFT, LTD., SIR W. G., Baginton, nr. Coventry (Tollbar 2261).

AUSTER AIRCRAFT, LTD., Rearsby Aerodrome, nr. Leicester (Rearsby 321). **S.B.A.C. Stand 165.**

BLACKBURN AND GENERAL AIRCRAFT, LTD., Brough, E. Yorkshire (Brough 121). **S.B.A.C. Stand F.**

BOULTON PAUL AIRCRAFT, LTD., Wolverhampton (Fordhouses 3191). **S.B.A.C. Stand B.**

BRISTOL AEROPLANE CO., LTD., Filton House, Filton, Bristol (Filton 3831). **S.B.A.C. Stand R.**

DART AIRCRAFT, LTD., The Market Place, Chalfont St. Peter, Bucks (Gerrards Cross 3881).

DE HAVILLAND AIRCRAFT CO., LTD., THE, Hatfield, Herts (Hatfield 2345). **S.B.A.C. Stand D.**

ELLIOTTS OF NEWBURY, LTD., Albert Works, Newbury, Berks. (Newbury 312).

ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, London, W.C.2 (Holborn 6966). **S.B.A.C. Stand Q.**

FAIREY AVIATION CO., LTD., Hayes, Middlesex (Hayes 3800). **S.B.A.C. Stand K.** (Australian and Canadian companies on S.B.A.C. Stands 81 and 82 respectively.)

FOLLAND AIRCRAFT, LTD., Sydney Lodge, Hamble, Hants (Hamble 3191). **S.B.A.C. Stand G.**

GLOSTER AIRCRAFT CO., LTD., Hucclecote, Glos (Gloucester 66294). **S.B.A.C. Stand J.**

HANDLEY PAGE, LTD., Claremont Road, Cricklewood, London, N.W.2 (Gladstone 8000). **S.B.A.C. Stand A.**

HANDLEY PAGE (READING), LTD., The Aerodrome, Woodley, nr. Reading, Berks (Sonning 2211).

HAWKER AIRCRAFT, LTD., Canbury Park Road, Kingston-on-Thames, Surrey (Kingston 1044). **S.B.A.C. Stand J.**

HESTON AIRCRAFT CO., LTD., THE, Heston Airport, Hounslow, Middlesex (Hayes 3844).

HUNTING PERCIVAL AIRCRAFT, LTD., The Airport, Luton, Beds (Luton 6060). **S.B.A.C. Stand O.**

MILES, LTD., F. G., Shoreham Airport, Shoreham-by-Sea, Sussex (Shoreham-by-Sea 2301).

ROE AND CO., LTD., A. V., Greengate, Middleton, Manchester (Failsworth 2020). **S.B.A.C. Stand J.**

SAUNDERS-ROE, LTD., East Cowes, I.O.W. (Cowes 2211). **S.B.A.C. Stands P and 144.**

SCOTTISH AVIATION, LTD., Prestwick Aerodrome, Ayrshire (Prest. 79888). **S.B.A.C. Stand H.**

SHORT BROS. AND HARLAND, LTD., Seaplane Works, Queens Island, Belfast (Belfast 58444). **S.B.A.C. Stand I.**

SLINGSBY SAILPLANES, LTD., Ings Lane, Kirbymoorside, Yorks (Kirbymoorside 312, 313).

SUPERMARINE.—See Vickers-Armstrongs.

VICKERS-ARMSTRONGS, LTD., Vickers House, Broadway, London, S.W.1. (Abbey 7777). **S.B.A.C. Stand S.**

WESTLAND AIRCRAFT, LTD., Yeovil, Somerset (Yeovil 1100). **S.B.A.C. Stand N.**

ENGINES

ALVIS, LTD., Holyhead Road, Coventry (Coventry 5501). **S.B.A.C. Stand L.**

ARMSTRONG SIDDELEY MOTORS, LTD., Parkside, Coventry (Cov. 62666). **S.B.A.C. Stand J.**

BLACKBURN AND GENERAL AIRCRAFT, LTD., Engine Division, Brough, Yorks (Brough 121). **S.B.A.C. Stand F.**

BRISTOL AEROPLANE CO., LTD., Engine Division, Filton House, Filton, Bristol (Filton 3831). **S.B.A.C. Stand R.**

BROCKWORTH ENGINEERING CO., LTD., Hucclecote, Gloucester (Gloucester 21531). (Production Unit for A.S. Motors, Ltd.)

DE HAVILLAND ENGINE CO., LTD., Leavesden Airfield, Herts (Garston 2261). **S.B.A.C. Stand D.**

NAPIER AND SON, LTD., D., The Vale, Acton, London, W.3 (Shepherds Bush 1220). **S.B.A.C. Stand E**

ROLLS-ROYCE, LTD., Nightingale Road, Derby (Derby 42424). **S.B.A.C. Stand C.**

STANDARD MOTOR CO., LTD., Banner Lane, Coventry (Coventry 66611). (Production Unit for Rolls-Royce, Ltd.)

MATERIALS

(Including Metals, Castings and Forgings, etc.; Wood and Plastics, excluding Finished Parts)

ACCLES AND POLLOCK, LTD., Oldbury, Birmingham (Broadwell 1797).—Manipulated tubes; movable joints; precision tubes in stainless steel and Monel. **S.B.A.C. Stand 152.**

AERO RESEARCH, LTD., Duxford, Cambridge (Sawston 187).—"Redux" bonding process for metal aircraft structures, including honeycombs; "Araldite" epoxy resins as adhesives for metals, casting resins, surface coatings and fillers; "Aerolite" glues for wood structures.

ALMIN, LTD., Farnham Royal, Bucks (Farnham Common 595).—"Aliminal" aluminium alloys in all forms.

BX PLASTICS, LTD., Highams Station Avenue, London, E.4 (Larkswood 5511).—Cobex lightweight non-inflammable construction material; styrafoil condenser insulating tape; polythene for packing and storing parts. **S.B.A.C. Stand 180.**

BAKELITE, LTD., 12-18 Grosvenor Gardens, London, S.W.1 (Sloane 0898).—Bakelite moulding materials; laminated sheet, rod and tube; resins; adhesives; Vybak P.V.C. moulding and extrusion compounds, rigid and flexible sheet. **S.B.A.C. Stand 93.**

BALFOUR AND CO., LTD., ARTHUR, Capital Steel works, Sheffield 3 (Sheffield 22071).—High-speed steels, alloy tool steels and plain carbon tool steel in bars and forgings. Engineers' small tools, e.g., drills, reamers, milling cutters, "Balfalloy" tipped tools, butt-welded high-speed steel lathe tools, hacksaw blades, etc., etc. **S.B.A.C. Stand 252.**

BAMBERGERS, LTD., 27/28, Finsbury Square, London, E.C.2 (Monarch 4466).—Specialists in hardwood, softwood and plywood for aircraft construction.

B. B. CHEMICAL CO., LTD., Ulverscroft Road, Leicester (Leicester 20175).—Manufacturers of "Bostik" adhesives and sealing compounds, and of "Prestik" sealing strip, for pressurizing cabins, sealing integral tanks, windscreen glazing.

BELDAM ASBESTOS CO., LTD., Hounslow, Middx (Hounslow 6441).—Jointings and precision mouldings for oil and fuel sealing applications.

BIRKETT AND SONS, LTD., T. M., Hanley, Stoke-on-Trent, Staffs (Stoke-on-Trent 2184-5-6-7).—A.I.D. and A.R.B. approved. Non-ferrous castings; precision machined parts; chill-cast rods, tubes.

BIRMETALS, LTD., Woodgate Works, Birmingham, 32 (Woodgate 2253).—Light alloy sheet, strip, extruded sections, rod, bar, tube and wire, including the "Birmabright" series; also magnesium-base alloy sheet, strip, extrusions and tube. **S.B.A.C. Stand 101.**

BIRMINGHAM ALUMINIUM CASTING (1903) CO., LTD., Birmid Works, Smethwick, Birmingham (Smethwick 1431).—Light-alloy and zinc-base castings for the aircraft industry. **S.B.A.C. Stand 150.**

BOOTH AND CO., LTD., JAMES, Argyle Street Works, Nechells, Birmingham, 7 (East 1521).—Extruded sections, tube, sheet, strip and forgings in aluminium alloys, brass and copper. **S.B.A.C. Stand 160.**

BRAKE LININGS, LTD., Bridge Street, Buxton (Buxton 776).—A.I.D. and A.R.B. approved for brake linings and clutch linings.

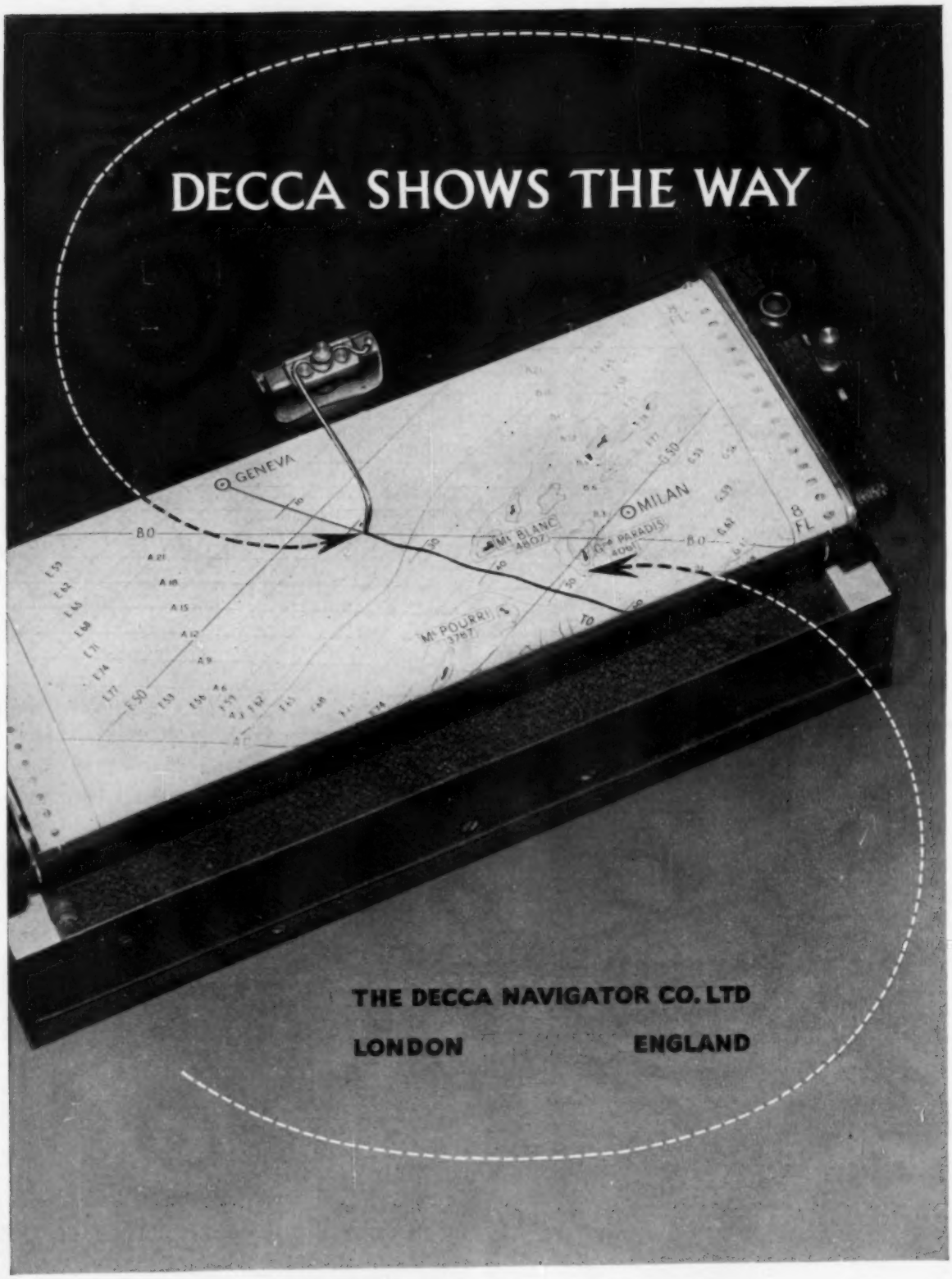
BRITANNIA TUBE CO., LTD., Glover Street, Birmingham (Victoria 0192).—A.I.D. and A.R.B. approved. Aluminium and alloy tubes, sections; manipulations: carbon and stainless-steel tubes, close joint, open joint.

BRITISH ALUMINIUM CO., LTD., Norfolk House, St. James's Square, London, S.W.1 (Whitehall 7868).—Producers of aluminium and aluminium-alloy ingot, plate, sheet, strip and tube to B.S. aircraft and D.T.D. specification. **S.B.A.C. Stand 13.**

BRITISH BELTING AND ASBESTOS LTD., Cleckheaton, Yorkshire (Cleckheaton 800).—Manufacturers of brake and clutch liners, parachute and equipment webbing, compressed asbestos fibre joints and jointing to D.T.D. specifications, solid woven asbestos tape, hollow braided tubing and anti-friction bearings. **S.B.A.C. Stand 29.**

BRITISH PLYWOOD MANUFACTURERS, LTD., Wharf Road, Ponders End, Middlesex (Howard 2424).—Manufacturers of aircraft plywood and components. A.I.D. approved.

BROWN BAYLEY STEELS, LTD., Sheffield 9 (Sheffield 41031).—Alloy and heat-resisting steels for aircraft, engines and components. Black and bright bars; forgings, stainless and heat-resisting sheet and strip; rolled or forged steel rings. **S.B.A.C. Stand 106.**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THE AIRCRAFT INDUSTRY . . .

Materials (continued)

CAPE ASBESTOS CO., LTD., 114-116 Park Street, London, W.1 (Grosvenor 6022).—Asbestos plastics in sheet, moulded and machined form. Moulded brake and clutch linings.

CARLISLE AND CO., LTD., C. G., 629 Penistone Road, Sheffield, 6 (Sheffield 43615).—Manufacturers of all types of stainless steels. A.I.D. and A.R.B. approved.

CARRON PARLANTI, LTD., Carron, Falkirk, Stirlingshire (Falkirk 35); London Office: 15 Upper Thames Street, E.C.4 (Central 7581).—"Niforge" castings, of high tensile-strength and fine surface finish, for turbine blades, couplings, pump bodies, etc., produced by the Parlanti mould process, using "temperature-graded" anodized light-alloy dies. **S.B.A.C. Stand 129.**

COLEY AND SON (HOUNSLOW), LTD., R. J., Chapel Road, Hounslow, Middlesex (Hounslow 2266/7/8).—Metal merchants, specialists in all types of aircraft scrap and redundancies. Branches at Manchester and Bristol.

DANIEL DONCASTER AND SONS, LTD., Penistone Road, Sheffield 6 (Sheffield 43081).—Drop forgings for aircraft engines; specialists in turbine and compressor blades in heat-resisting alloys, heat-resisting and stainless steels, aluminium bronze and titanium, for jet engines. Connecting rods and valve forgings, gears, etc., for piston engines.

Gun mounting, sand-cast in Magnuminium (High Duty Alloys) for Armstrong Whitworth Aircraft.

DUDLEY DROP FORGING CO., LTD., Holly Hall, Dudley, Worcs (Brierley Hill 7561-5).—Steel drop forgings.

ENGLISH STEEL CORPORATION, LTD., River Don Works, Sheffield, 9 (Sheffield 41071), and North Street Works, Openshaw, Manchester (Manchester East 1371).—Drop-forged parts from special aero steels for gas-turbine engines; crankshafts; airscrew shafts and hubs; landing-gear parts; gears. Engineers' cutting tools. **S.B.A.C. Stand 114.**

ENTHOVEN AND SONS, LTD., H. J., 89 Upper Thames Street, London, E.C.4 (Mansion House 4533).—Manufacturers of lead and lead alloys, solid solders, cored solders, solder specialities and fine chemicals.

FERODO, LTD., Chapel-en-le Frith, via Stockport (Chapel-en-le-Frith 2520).—Brake linings, stair-treads, "Ferobestos" plastics.

FIBREGLASS, LTD., Ravenhead, St. Helens, Lancs (St. Helens 4224).—"Fibreglass" products for heat, sound and electrical insulation in aircraft, and "Fibreglass" reinforced plastics. **S.B.A.C. Stand 221.**

FIRTH AND JOHN BROWN, LTD., THOS., Atlas Works, Sheffield, 4 (Sheffield 20081).—Black and bright bars, billets, sheets and strip in high-speed and tool steel; carbon and alloy and special steels. Forged steel cylinders, rings and other forgings for aircraft, gas turbines and jet propulsion units. **S.B.A.C. Stand 175.**

FIRTH-DERIHON STAMPINGS, LTD., THE, Tinsley, Sheffield, 9 (Sheffield 42051).—Drop forgings in creep-resisting steels and alloys, and special-quality alloy steels for engine and airframe components, including turbine and compressor discs, blades, shafts; connecting rods; gears; propeller hubs. **S.B.A.C. Stand 176.**

FIRTH-VICKERS STAINLESS STEELS, LTD., Staybrite Works, Sheffield, 9 (Sheffield 42051).—"Staybrite", stainless, heat- and creep-resisting aircraft steels—sheet, bars, strip; static, centrifugally-cast, centri-die-cast and precision-cast components for gas turbines. **S.B.A.C. Stand 216.**

FLATHER, LTD., W. T., Standard Steel Works, Tinsley, Sheffield, 9 (Sheffield 41152).—Steels for airframe and engine components; steels for jigs and tools; case-hardening compounds. **S.B.A.C. Stand 112.**

FLEXO PLYWOOD INDUSTRIES, LTD., Hall Lane, South Chingford, London, E.4 (Silverthorn 2666). — Sandwich constructions of all kinds (insulating—high strength-weight ratio). Resinated glass and asbestos laminates and mouldings.

FOTHERGILL AND HARVEY (SALES), LTD., Harvester House, Peter Street, Manchester 2 (Blackfriars 3232).—Tyglas woven glass fabric; Tygan woven monofilament fabric.—**S.B.A.C. Stand 248.**

FOX AND CO., LTD., SAMUEL, Stockbridge Works, nr. Sheffield (Sheffield 40871). — Stainless and special alloy steels for high-temperature service. **S.B.A.C. Stand 168.**

GILLOTT AND SONS, JOSEPH, Sheffield, 11 (Sheffield 74423).—Die steels, high-speed-tool and alloy steels.

GLOSTER ENGINEERING (CHELTENHAM), LTD., 30, St. Paul's Street North, Cheltenham (Cheltenham 53961).—Router templates, rubber press dies, Hufford stretch tools, etc., in "Bakelite," laminated hardwoods and glass plastics. **S.B.A.C. Stand 73.**

HABERSHON AND SONS, LTD., J. J., Holmes Mills, Rotherham, Yorks (Rotherham 2081/6).—Steels to aircraft specifications, in hot- and cold-rolled strip and sheets. **S.B.A.C. Stand 109.**

HADFIELDS, LTD., Sheffield 9 (Sheffield 41001).—Steel castings and forgings; turbine discs and stator rings for gas turbines; precision castings, heat-resisting and stainless steels, shell-moulded castings. **S.B.A.C. Stand 251.**

HALL AND HALL, LTD., Oldfield Works, Hampton, Middlesex (Molesey 2180).—Natural and synthetic rubbers to various Ministry of Supply specifications; technical mouldings and extrusions for aircraft work; hydraulic seals and jointing materials. "Maricon" hose assemblies, D.T.D. (R.D. 1) 3951. **S.B.A.C. Stand 207.**

HALL AND PICKLES, LTD., Port Street, Manchester (Central 4571).—"Hydra," "Hydraloy" hard metal, "Hydraweld" butt-welded tools, standards and specials. Tool bits. High-speed, alloy, cast, and stainless steels. Stainless and heat-resisting wire. **S.B.A.C. Stand 51.**

HIGH DUTY ALLOYS, LTD., Slough, Bucks (Slough 23901).—Castings, forgings, stampings, pressings, extrusions, sheet and plate in "Hiduminium" and "Magnuminium" aluminium and magnesium alloys. Compressor blades in "Hiduminium," aluminium bronze and Nimonic. **S.B.A.C. Stand 113.**

HORDERN-RICHMOND, LTD., Haddenham, Bucks. (Aylesbury 1100).—"Hy-du-lignum" laminated compressed wood; "Hy-du-lignum" and glass laminates, jigs and tools; helicopter rotor blades; wind-tunnel fans; Aeromatic propellers. **S.B.A.C. Stand 123.**

HUGHES-JOHNSON STAMPINGS, LTD., THE, Langley Green, Birmingham (Broadwell 1361).—

Forming tool of Bakelite Laminated for a Venom wing-tank baffle is cut on a router at de Havilland's Portsmouth factory.

Drop-forgings of the more intricate type, in carbon, nickel, nickel-chrome and all alloy steels; non-ferrous high-nickel chrome alloys; Copper, aluminium alloys and titanium alloys. **S.B.A.C. Stand 56.**

IMPERIAL CHEMICAL INDUSTRIES, LTD. (Metals Division), Kynoch Works, Witton, Birmingham (Birchfields 4848).—Sheet, strip, plates, extrusions, wire and tubes in copper and copper alloys and in aluminium and aluminium alloys.

INDUSTRIAL TAPES, LTD., Speedfix House, 142/146 Old Street, London, E.C.1.—"Speedfix" self-adhesive tapes, plain and printed, in cellulose, cloth, paper, P.V.C., ethyl acetate, etc.

JABLO PROPELLERS, LTD., Mill Lane, Waddon, Croydon, Surrey (Croydon 2201).—Propeller, helicopter-blade, lightweight bulkhead and flooring materials; Jabroc tools; sandwich panels with Aero Jablex core and glass fabric facings; thermal and sound insulation. **S.B.A.C. Stand 174.**

JESSOP AND SONS, LTD., WILLIAM, Brightside Works, Sheffield (Sheffield 41352).—Special alloy and tool steels, constructional steels, valve steels, high-temperature steels, permanent magnets, forged or drop-stamped gas-turbine discs, forged or precision-cast blades. **S.B.A.C. Stand 32.**

KAYE, LTD., E. AND E., Ponders End, Enfield, Middlesex (Howard 1601).—Aluminium alloy bars, tubes and extruded sections. Copper and aluminium wire strip and strand. Paper- and cotton-covered winding wires. A.I.D. and A.R.B. approved.

KAYSER, ELLISON AND CO., LTD., Carlisle Steel Works, Sheffield, 4 (Sheffield 22124).—High-grade tool, high-speed, alloy, stainless and free-cutting steels, and heat-resisting steels for internal combustion engines.

KENILWORTH MANUFACTURING CO., LTD., "Hermetite" Works, West Drayton, Middlesex (West Drayton 3047).—A.I.D. and A.R.B. approved. Hermetite jointing compounds; plastic jointing for sealing spot-welded joints; hydraulic fluids; metal cement; aluminium paints; new flexible Hermetite 1326B. **S.B.A.C. Stand 202.**

KENT ALLOYS, LTD., Rochester, Kent (Strood 7674).—Sand, die and shell castings to A.I.D. specs.; aluminium, magnesium, magnesium-zirconium and copper alloys; iron; machining; Argon Arc welding; X-Ray; Gamma ray; final assemblies. **S.B.A.C. Stand 232.**

LONDON PLYWOOD AND TIMBER CO., LTD., Wharf Road, Ponders End, Middlesex (Howard 2424).—Suppliers of aircraft-quality English ash, mahogany and silver spruce to the industry. A.I.D. and A.R.B. approved.

LONG AND HAMBLY, LTD., Slater Street, High Wycombe, Bucks (High Wycombe 2321). — Accurate injection and compression mouldings in natural rubber and synthetics. Bonded leads; rubber-to-metal parts; visors; grommets, gaskets, etc. **S.B.A.C. Stand 250.**

LOW MOOR ALLOY STEEL WORKS, LTD., Low Moor, Bradford (Low Moor 663).—High-speed steel, tool steel, special steel, corrosion- and heat-resisting steels, in ingots, blooms, billets, slabs, sheets, strip, bar (flat, square and rounds), wire, rod, etc.

LOW MOOR FINE STEELS, LTD., Low Moor, Bradford (Low Moor 1544/7).—Special steel extrusions.

MAGNESIUM ELEKTRON, LTD., Clifton Junction, Manchester, (Swinton 2511).—Castings in Elektron magnesium-base, zirconium- and thorium-containing alloys. Sheet, extrusions and forgings. Components fabricated from sheet and extrusions. **S.B.A.C. Stand 166.**

MILLS, LTD., WILLIAM, Friar Park Road, Wednesbury, Staffs (Stonecross 2276/7/8).—Aluminium-alloy founders; sand, gravity-die and pressure-die castings for aircraft and other industries. A.I.D. and A.R.B. approved.

MINNESOTA MINING AND MANUFACTURING CO., LTD., Arden Road, Adderley Park, Birmingham, 8 (East 2051). — 3M coated abrasives, 3M adhesives, "Scotch Boy" pressure-sensitive tapes. Cellulose tape — masking, electrical, etc. "Safety-Walk" non-slip surfacing.

Airframe and engine castings by David Brown Foundries Co., Ltd.

THE AIRCRAFT INDUSTRY . . .

Materials (continued)

MOND NICKEL CO., LTD, Sunderland House, Curzon Street, London, W.1 (Grosvenor 4131).—Nickel refiners. Information on nickel-containing materials. **S.B.A.C. Stand 215.**

NORTHERN ALUMINIUM CO., LTD., Bush House, Aldwych, London, W.C.2 (Temple Bar 8430).—Noral aluminium and aluminium alloy sheet, strip, plate, sections, tubes, rod, bar, wire, forgings, castings; Alpaste for paint. **S.B.A.C. Stand 94.**

OMES, LTD., Beverley Works, Barnes, London, S.W.13 (Prospect 2291).—Producers of electro-upset forgings and drop stampings for aircraft and gas turbines. A.I.D. approved. Designers and manufacturers of resistance up-setting and heating machines. **S.B.A.C. Stand 103.**

PERADIN AND WATERCRAFT, LTD., Freshford, nr. Bath, Somerset (Limpley Stoke 3263).—Makers of "Peratol" (aircraft cabin sealant); specialists in rubber-to-metal bondings and rubber mouldings. A.I.D., A.R.B., I.F.V. and C.I.A. approved.

RENFREW FOUNDRIES, LTD., Hillington, Glasgow (Halfway 3391). —Sand, gravity and pressure-die castings in "Alminal" aluminium alloys. **S.B.A.C. Stand 183.**

REYNOLDS TUBE CO., LTD., Tyseley, Birmingham. 11 (Acocks Green 3333).—Seamless steel tubing, straight or manipulated; welded assemblies, engine mountings and rings; manipulated aluminium tubes and solid sections; fabrication of structures; aluminium-alloy pressure vessels. Manipulated stainless-steel sections. Plastic tubing; glass-fibre-reinforced resin ducting. **S.B.A.C. Stand 153.**

ROBERTSON THAIN, LTD., Ellesmere Port, Wirral, Cheshire (Ellesmere Port 2341).—"Stypol" polyester resins. 18 grades ranging from heat-resistant and fire-resistant laminating types for radome applications to flexible types to withstand extreme vibration.

ROLLET AND CO., LTD., H., 6 Chesham Place, London, S.W.1 (Sloane 3463).—Non-ferrous materials for aircraft experimental and prototype work.

SARO LAMINATED WOOD PRODUCTS, LTD., Polly Works, Whippenham, Isle of Wight (Cowes 704). —Decorative panelling; flush doors; Medino partitioning; Sarolite roofing material; glass-reinforced laminates; SaR-ReZ plastic finishes.

SCOTT BADER AND CO., LTD., Wollaston, Wellingborough, Northants (Wollaston 262). — Manufacturers of A.I.D. and A.R.B. approved polyester resins for all types of glass-fibre laminates and mouldings.

SENIOR AND SONS, LTD., GEORGE, Ponds Forge, Sheffield 1, Yorkshire (Sheffield 25174). — Forgers, tilters and annealers.

SMITH-CLAYTON FORGE, LTD., Lincoln (Lincoln 1251). — Gas-turbine and other forgings in heat-resisting steels.

SMITH'S STAMPING WORKS (COVENTRY), LTD., Ribble Road Works, Humber Avenue, Coventry (Coventry 3151-3).—Steel drop forgings, specialists in high-temperature and alloy steels. **S.B.A.C. Stand 148.**

SOUTHERN FORGE, LTD., Meadfield Road, Langley, Bucks (Langley 301).—"Alminal" aluminium alloy bars, rods, sections, tubes, forgings and stampings. **S.B.A.C. Stand 184.**

STERLING METALS, LTD., Northey Road, Coventry (Coventry 89031).—Sand and gravity die light alloy castings in aluminium, magnesium "Elektron" and magnesium-"Elektron" zirconium alloys. **S.B.A.C. Stand 12.**

STONE AND CO. (CHARLTON), LTD., J., London, S.E.7 (Greenwich 3277). — Aircraft and aero-engine castings by sand, die and precision casting methods in aluminium, magnesium and copper-base alloys; bronze forgings. **S.B.A.C. Stand 186.**

T.I. ALUMINIUM, LTD., Redfern Road, Tyseley, Birmingham, 11 (Acocks Green 3333).—Aircraft sheet to all B.S.S. and A.I.D. specifications; coiled strip and a wide range of extruded sections as used in leading aircraft. **S.B.A.C. Stand 169.**

TALBOT STEAD TUBE CO., LTD., Green Lane, Walsall (Walsall 4186). — Cold-drawn stainless-steel tubes and bars; bright drawn bars; machined stainless aircraft fittings; manipulated and fabricated pipework; bi-metal tubes. **S.B.A.C. Stand 259.**

TAYLOR AND CO. (IRON-FOUNDERS), LTD., ROBERT, Muirhall Foundry, Larbert, Stirlingshire (Larbert 444).—Alloy cast-irons and alloy ductile irons for gas-turbine compressor casings and various components.

TRIPLEX SAFETY GLASS CO., LTD., 1 Albemarle Street, London, W.1 (Hyde Pk. 8171); King's Norton (Birmingham); and Willesden, London.—Manufacturers of safety glass and thermo-plastic materials for aircraft glazing. Products include bullet-, pressure- and bird-resistant glasses and heated glasses for de-icing. **S.B.A.C. 189.**

TUBES, LTD., Aston, Birmingham (Aston Cross 3030).—Tubular forgings for jet-engine compressor and turbine shafts; contra-rotating airscrew shafts, variable-pitch airscrew parts, cylinder liners, and other components. **S.B.A.C. Stand 77.**

TUNGUM CO., LTD., THE, Brandon House, Painswick Road, Cheltenham (Cheltenham 5856).—"Tungum" tubes, rod, bar, sheet, strip, wire, wire ropes, gauze. Tube fabrication. Machining to A.I.D. requirements. **S.B.A.C. Stand 188.**

TURNER BROTHERS ASBESTOS CO., LTD., Rochdale (Rochdale 4221).—Durestos resinated felts and moulding flock and Duraglas glass fabrics of special interest to manufacturers of aircraft components and accessories. **S.B.A.C. Stand 219.**

UNITED STEEL COMPANIES, LTD., Westbourne Road, Sheffield, 10 (Sheffield 60081).—Forgings, steel plates, alloy and special steels; steel strip and wire.

VANE AND CO., A. H., Empire House, St. Martins-le-Grand, London, E.C.1 (Metropolitan 9201-2).—A.I.D. and A.R.B. approved textile fabrics, tapes, webbings, cordage, sewing threads, etc.

WALLINGTON WESTON AND CO., LTD. (inc. Frome Plastics, Ltd.), Frome, Somerset (Frome 2206/7/8).—Manufacturers and suppliers of thermoplastics and thermo-setting plastics, synthetic and natural rubber mouldings, seals, etc.; non-flam sponge rubber and upholstery sheeting. A.I.D. and A.R.B. approved. **S.B.A.C. Stand 74.**

WIGGIN AND CO., LTD., HENRY, Wiggin Street, Birmingham 16 (Edgbaston 2245).—Wrought nickel alloys in all engineering forms. Producers of the Nimonic series of alloys, standard for blades of all British turbines. **S.B.A.C. Stand 44.**

WILSON AND SONS (LONDON), LTD., W., 1/3 Chalfont Road, Holloway, N.7 (North 4476-8).—A.I.D. and A.R.B. approved stockists of aluminium and aluminium alloy tubes, sheets, strip, rods and sections.

WOODS, SONS AND CO. (FIBRES), LTD., 6 Milk Street, London, E.C.2 (Monarch 0488).—Aero fabrics, tapes, cords, threads, cables. A.I.D. and A.R.B. approved.

WHYTE AND COLLINS, LTD., Kelvin Foundry, Fenton, Stoke-on-Trent (Stoke-on-Trent 48107). — Centrifugally cast components — bushes, gear blanks and solid bars, in non-ferrous metals.

YORKSHIRE COPPER WORKS, LTD., Leeds (Leeds 72222).—Solid drawn tubes in copper, brass, cupro-nickel, aluminium-brass and other special non-ferrous alloys; capillary fittings; oil and petrol pipes.

YORKSHIRE ENGINEERING SUPPLIES, LTD., Leeds, 12 (Leeds 38234 and 38291).—Manufacturers of high-grade phosphor bronze and gunmetal castings and bars, and finished machine parts. Bushes and plain bearings.

AIRCRAFT PARTS

(Including Airframe and Engine Components and Accessories; Precision Engineering; Presswork; A.G.S. Parts.)

A.B.C. MOTORS, LTD., Walton-on-Thames, Surrey (Walton-on-Thames 774/775).—Aeronautical and precision engineers. Designers and manufacturers of airborne auxiliaries, generating and pumping units.

A.V.A., LTD., 45-47, York Street, Twickenham, Middlesex (Popesgrove 7931).—A.I.D. and A.R.B. approved. Anti-vibration mountings and shock-absorbers for instrument panels, engines, etc. Speciality mountings resistant to extremes of temperature.

ABBEY PANEL AND SHEET METAL CO., LTD., Old Church Road, Little Heath, Coventry (Coventry 89461). — Intricately-shaped metal fabrications; brazing, welding and light presswork; prototype works. A.I.D. approved.

ACORN SPRING WORKS, LTD., 98 Villiers Road, London, N.W.2 (Willesden 1095).—Precision springs; helical tension, torsion and compression; wire shapes; flat springs and presswork. A.I.D. approved.

ACTON BOLT, LTD., 26 Chase Road, London, N.W.10 (Elgar 5775). —Manufacturers of "Bees" bolts. Cold-headed, rolled-thread aircraft and commercial bolts; steel and brass screws; self-tapping and Phillips recessed screws; nuts and bright steel parts; parts to customers' requirements. **S.B.A.C. Stand 118.**

AERO CONTROLS, LTD., Industrial Estate, Weedon Road, Northampton (Northampton 32276-7).—Aircraft, flying, engine and locking controls; gearboxes, universal joints, control bearings, push-pull torque controls; prefabricated servicing equipment. Fasteners: screw and toggle types and Martin lock nuts. **S.B.A.C. Stand 30.**

AEROLEX, LTD., Camberley, Surrey (Camberley 1500). — Precision engineers, aircraft-component manufacturers and toolmakers; quick-release lashing equipment, safety-belts, etc.

AEROPLASTICS, LTD., Earl Haig Road, Hillington, Glasgow (Halfway 1683).—Moulded plastic components. **S.B.A.C. Stand 83.**

AIRCRAFT MATERIALS, LTD., 103 Midland Road, London, N.W.1 (Euston 6151).—"Pop" rivets, "Pop" riveting equipment; parachute quick-release mechanisms and fittings, pipe couplings, seals; bolts, nuts, washers, shackles, turnbuckles, rivets, electrical parts, fabrics, cable ducting; metals to all approved specifications. **S.B.A.C. Stand 120.**

AIRFLOW STREAMLINES, LTD., Main Road, Far Cotton, Northampton (Northampton 32472/3/4). — Sub-contractors of sheet metal pressings, detail parts, sub-assemblies, and major assemblies to the aircraft industry.

AIR SERVICE TRAINING, LTD., Hamble, Southampton (Hamble 2181).—Aircraft Division: Gas-turbine installations, towed targets, aircraft repairs, component manufacture and ground equipment (See also under "Miscellaneous.") **S.B.A.C. Stand J.**

AMAL, LTD., Witton, Birmingham, 6 (Birchfields 4571).—Manufacturers of flame-traps, flowmeters, jet calibrators, fuel filters, non-return and pressure-regulating valves, cowling fasteners, ball and roller joints; machined assemblies, etc., to manufacturers' specification.

ANGUS AND CO., LTD., GEORGE, Oil Seal Division, Newcastle upon Tyne, 6 (Newcastle 56161).—Angus oil and fluid seals; Gaco M.I. oil seals for rotating shafts; Gaco hydraulic packings; diaphragms, gaskets, valve seats, etc.

ARENS CONTROLS, LTD., Tunstall Road, East Croydon, Surrey (Addiscombe 3051-4). — Mechanical remote controls.

ASHDOWNS, LTD., Eccleston Works, St. Helens, Lancs (St. Helens 3206).—Fibreglass reinforced laminates and tubes incorporating various resins; copper-clad laminates; Perspex and P.V.C. fabrications; paper and cotton-cloth laminates; plastic mouldings. **S.B.A.C. Stand 220.**

ASTON AND CO., LTD., E. S., 5 Sebastian Street, London, E.C.1 (Clerkenwell 2179).—Machinists of laminated plastics, cast resin, fibre, ebonite, etc. A.I.D. and A.R.B. approved.

ATTEWELL AND SONS, LTD., B., Reflection Works, Southall, Middx. (Southall 2888, 3555).—Laminated aluminium and brass sheets; shims and washers; press tools. Perspex tableware for use in aircraft. **S.B.A.C. Stand 46.**

AUTO-KLEAN STRAINERS, LTD., Hounslow, Middx (Hounslow 6441).—Filters and strainers for fuel, lubricating oil and hydraulic systems.

AUTOMOTIVE PRODUCTS CO., LTD., Leamington Spa (Leamington Spa 2700).—Manufacturers of Lockheed Avery hoses and self-sealing couplings; Purolator oil, fuel and air filters. **S.B.A.C. Stand 208.**

AVIATION TRADERS (ENGINEERING), LTD., 15 Great Cumberland Place, London, W.1 (Ambassador 2091) (works at Southend and Stansted Airports).—Manufacture of sub-assemblies, components and special equipment. A.I.D. and A.R.B. approved. **S.B.A.C. Stand 102.**

Flexible-pipe assembly made by Avica Equipment, Ltd.

AVICA EQUIPMENT, LTD., 1 Adams Place, Georges Road, Holloway, London, N.7 (North 4281).—Stainless-steel and synthetic-rubber flexible-pipe assemblies for aircraft, rocket and guided-weapon installations. Support clamps for pipe and cable runs. High-pressure swivel pipe couplings. Thermocouple and low-tension and high-energy ignition harnesses. **S.B.A.C. Stand 228.**

AVIMO OF TAUNTON, Taunton, Somerset (Taunton 3634). — Pressure-heads, pipe couplings, oxygen regulators, cameras, cathode-ray recording equipment, etc.

BAXTERS (BOLTS, SCREWS, RIVETS), LTD., Sheepcote Street, Birmingham, 15 (Midland 0105).—Precision rivets for flush riveting.

BELL'S ASBESTOS AND ENGINEERING, LTD., Bestobell Works, Slough, Bucks (Slough 25151).—Air-conditioning and de-icing components. Silastic products, jointings, fire seals, moulded sleeves, insulation; pressure trolley hose and asbestos-insulated concertina air-conditioning hose. **S.B.A.C. Stand 97.**

BENTON AND STONE, LTD., Aston Brook Street, Birmingham, 6 (Aston Cross 1905).—Air cylinders, control valves, etc., lubricating systems, fuel cocks and filters, oil cans, disinfectant sprayers. A.G.S. fittings.

BLOCTUBE CONTROLS, LTD., Bicester Road, Aylesbury, Buckinghamshire (Aylesbury 828-830).—Mechanical remote controls, control pedestals.

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Aircraft Parts (continued)

BOLTON AND SONS, LTD., THOMAS, Mersey Copper Works, Widnes, Lancashire (Widnes 2022).—Machined forgings and components in copper-bearing alloys; bearings, housings, bushes, liners, sleeves, cylinder-head inserts, and other engine and airframe details.

BOORN AND CO., LTD., THOMAS, Venn Street, Clapham, London, S.W.4 (Macaulay 3060).—Fuel hose and fuel-hose assemblies, Flylite series hoses, lightweight and fire resisting. Flylink couplings and elbows. Flyclamp all-metal flanged couplings. **S.B.A.C. Stand 132.**

BOULTON PAUL AIRCRAFT, LTD., Wolverhampton (Fordhouses 3191).—Designers and manufacturers of aircraft and armament, powered controls, hydraulic equipment and electronic research and test instruments. **S.B.A.C. Stand B.**

BOWDEN (ENGINEERS), LTD., Willesden Junction, London, N.W.10 (Elgar 4805).—High- and low-pressure hose units with swaged and detachable, re-usable end fittings. Wire mechanism control assemblies with swaged end fittings. Cables, conduits and control levers. **S.B.A.C. Stand 87.**

BRAMAH AND CO., LTD., J. R., Devonshire Street, Sheffield 3 (Sheffield 24228/9). — Manufacturers of aircraft tanks, light-alloy and stainless steel fabrications, pressings and spinnings.

BRIGGS MOTOR BODIES, LTD., Swaythling, Southampton (Southampton 55611 and 55625).—Manufacturers of sheet-metal combustion components for gas turbines, i.e., jet-pipes, flame-tubes, exhaust units, combustion chambers, in Nimonic, stainless steel, etc.

BRITISH EMULSIFIERS, LTD., 3 Red Place, London, W.1 (Mayfair 9358/9). — Manufacturers of fuel tanks and other components in sheet metal, Durestos and Fibreglass. Fabrications in light alloys and reinforced plastics. (Associate companies: W. and A. Williamson and Co., Ltd., and Jet Tanks, Ltd.) **S.B.A.C. Stand 206.**

BRITISH ERMETO CORPORATION, LTD., Beacon Works, Hargrave Road, Maidenhead (Maidenhead 2271). — High-pressure pipe couplings and valves. **S.B.A.C. Stand 19.**

BRITISH MANUFACTURED BEARINGS CO., LTD., Crawley, Sussex (Crawley 1030). — Precision miniature ball bearings from 1 mm bore diameter. Precision steel and jewel balls from 0.003in diameter. Bearing handling and assembly tools. Pressurized assembly cabinets. **S.B.A.C. Stand 226.**

BRITISH MESSIER, LTD., Cheltenham Road, Gloucester (Churchdown 3281).—Aircraft landing gear, wheels, brakes, hydraulic equipment, flying controls. **S.B.A.C. Stand 54.**

BRITISH TIMKEN, LTD., Cheston Road, Aston, Birmingham, 7 (East 1321/8), and Duston, Wolverhampton (Wilton 4921/8).—Timken tapered roller bearings for aircraft, including special types for v.p. airscrews and for helicopters, landing wheels and controls.

BRITISH WIRE PRODUCTS, LTD., Worcester Road, Stourport-on-Severn, Worcs (Stourport 240).—Cable controls and fittings; slings; launching bridles; tubes and tube bending. **S.B.A.C. Stand 60.**

BROOKS (AUTOS) LTD., T. J., Beech Street, Leicester (Leicester 60987).—Aircraft bolts, screws, nuts, studs and A.G.S. parts in mild, high-tensile and stainless steels and light alloys. Cadmium plating; prepackaging. A.I.D. and A.R.B.

BROWN AND CO., LTD., E. G., West Road, Tottenham, London, N.17 (Tottenham 2257).—Fuel and oil tanks, pilots' seats, cowlings, fabrications in light alloy, pressings and stampings.

BROWN AND SONS (HUDDERSFIELD), LTD., DAVID, Park Works, Huddersfield, Yorkshire (Huddersfield 3500). — High-tensile steel castings for airframes; heat-resisting centrifugal castings for gas turbines; bronze castings; aircraft gears; gear-cutting tools; reamers. **S.B.A.C. Stand 241.**

BROWN BROTHERS (AIRCRAFT), LTD., Bedford Road, Northampton (Northampton 4940).—Manufacturers and stockists of complete range of A.G.S., S.B.A.C. and B.S. parts; sole manufacturers of Oddie nuts and Hi-Shear rivets; Hydraulic aircraft jacks, 3-25 tons; repetition machining; press work and assemblies; metal stockists. **S.B.A.C. Stand 156.**

BRUNTONS (MUSSELBURGH), LTD., Musselburgh, Scotland. — Aircraft cables, cable assemblies, streamline wires, tie rods, whip aerials, aerofoil blading, cold-rolled strip, fatigue-testing machines, stainless-steel wire.

BURNLEY AIRCRAFT PRODUCTS, LTD., Burnley, Lancs (Burnley 3121). — Specialists in development work and manufacture of jet combustion units; repair contracts for jet-pipes, flame tubes, exhaust units and discharge nozzles.

CLERKENWELL SCREWS, 109 Clerkenwell Road, London, E.C.1 (Holborn 1215 and 6504).—Rolled and turned screws, nuts and washers, 0 B.A. to 16 B.A. in brass and steel. Spring, Shakeproof and fibre washers; studding.

CLAYTON - WRIGHT, LTD., HOWARD, Wellesbourne, Warwick (Wellesbourne 316/7/8). — A.I.D. approved. Flexible bearings; anti-vibro mounts; flexible-pipe unions; rubberised pipe clips; "Nylastic" (nylon) adjustable support clips and cable hangers; self-sealing weather strips; kompolastic joints or gaskets; "O" rings, etc.

COMOY AND CO., LTD., H., 90-92, Pentonville Road, London, N.1 (Terminus 5704).—Machinists and fabricators of laminated plastic components; laminated plastic instrument and control panels; moulded aircraft components. A.I.D. and A.R.B. approved.

COOPERS MECHANICAL JOINTS, LTD., Liverpool Road, Trading Estate, Slough, Bucks (Slough 24511). — Gaskets, joints, washers and shims for all applications; A.I.D. Part 1 approval. **S.B.A.C. Stand 55.**

COOPERS MECHANICAL JOINTS, LTD., Llanfoist Works, Abergavenny, Mon. (Abergavenny 550).—Air and liquid filters; intake screens, gauze strainers, breathers. A.I.D. Part 1 approval. **S.B.A.C. Stand 55.**

CORNERCROFT, LTD., Ace Works, Coventry (Coventry 64123). —Aircraft components and assemblies, sheet metal work, assembly fixtures, jigs, tools, pressings, prototype and experimental work, precision machine work.

CROSS MANUFACTURING CO. (1938), LTD., 33, Midford Road, Combe Down, Bath (Combe Down 2355).—Engine and machine development, labyrinth seals, spring washers to B.S.S. SP.47, wire thread inserts, circlips.

Oddie nut, manufactured by Brown Brothers (Aircraft), Ltd.

DANCER AND HEARNE BROS., LTD., Aircraft Division, Lindsay Avenue, High Wycombe (High Wycombe 1242).—Repair and manufacture of airframe structures. Jig and tool makers. Producers of compressed and densified timber.

DART AIRCRAFT, LTD., The Market Place, Chalfont St. Peter, Bucks (Gerrards Cross 3881, Denham 2409).—Light-aircraft constructors; components in wood and metal; sheet-metal work; tubular structures, welding, plastics.

DE HAVILLAND PROPELLERS, LTD., Lostock, Bolton, Lancs (Horwich 480).—See under "Accessory Developments" section preceding this review.

DELANEY GALLAY, LTD., London, N.W.2 (Gladstone 2201).—Design, test and manufacture of thermal insulation, heat-exchangers, oil coolers, radiators, cabin heaters, wing de-icers, fuel tanks, etc. Components for jet aircraft and guided missiles; research and development. **S.B.A.C. Stand 200.**

DOWSING CO. (ELECTRICAL MANUFACTURERS), LTD., Kangley Bridge Road, Lower Sydenham, London, S.E.26 (Sydenham 7016).—Light engineering aircraft parts.

DOWTY EQUIPMENT, LTD., Cheltenham, Glos. (Cheltenham 53471).—Designers and manufacturers of aircraft undercarriages, hydraulic and electrical equipment. **S.B.A.C. Stand 22.**

DOWTY EQUIPMENT OF CANADA, LTD., Ajax, Ontario, Canada.—Manufacturers of aircraft undercarriages, hydraulic and electrical equipment. **S.B.A.C. Stand 25.**

DOWTY FUEL SYSTEMS, LTD., Cheltenham, Glos. (Cheltenham 53471).—Designers and manufacturers of pumps, spill burners and fuel systems for gas turbines. **S.B.A.C. Stand 24.**

DOWTY SEALS, LTD., Ashchurch, Glos. (Tewkesbury 2271).—Designers and manufacturers of seals and mouldings in synthetic and silicone rubbers and P.T.F.E. and other plastic materials. **S.B.A.C. Stand 23.**

DUNLOP RUBBER CO., LTD. (Aviation Division), Coventry (Coventry 88733).—Tyres, wheels, brakes, pneumatic and hydraulic operating equipment; windscreen wipers; de-icing equipment; compressors, flexible pipes and rubber accessories. **S.B.A.C. Stand 151.**

DZUS FASTENER (EUROPE) LTD., Farnham Factory Estate, Farnham, Surrey (Farnham 4422).—Dzus fasteners: panel mounting, supersonic self-ejecting and standard types in various types and sizes. **S.B.A.C. Stand 84.**

E.N.V. ENGINEERING CO., LTD., Hythe Road, Willesden, London, N.W.10 (Ladbroke 3622).—Straight-tooth, spiral and hypoid gears; spur and helical gears. Precision curved-tooth and spur gears for high-speed applications. A.I.D. approved. **S.B.A.C. Stand 164.**

ELECTRO-HYDRAULICS LTD., Liverpool Road, Warrington, Lancashire (Warrington 2244).—Landing gear, hydraulic systems and components; electro-hydraulic and fuel valves, powered flying controls. **S.B.A.C. Stand 16.**

EQUATOR WHEELS AND SECTIONS, LTD., Raglan Street, Wolverhampton (Wolverhampton 21605/6).—Manufacturers of stainless-steel stiffening bands for jet engines; cold rolling; forming and coiling in all metals; manipulators of profiles.

ESSEX AERO, LTD., The Airport, Gravesend, Kent (Gravesend 4261). —Specialists in magnesium fabrications, including oil and fuel tanks, door and window frames. Castings, pressings, forgings in light or ultra-light alloys. **S.B.A.C. Stand 257.**

EVERSHED AND VIGNOLES, LTD., Acton Lane Works, Chiswick, London, W.4 (Chiswick 3670). —Position-controllers for engine throttle, flap and airscrew-pitch control; "Megger" insulation testers; "Megger" bond testers; servo motors.

Ball and parallel roller bearings by Fischer Bearings Co., Ltd.

EXACTOR, LTD., 108 Park Street, London, W.1 (Mayfair 0252-4), and Exactor Works, Edgware, Middlesex. —Hydraulic components; self-sealing couplings, inc. refuelling connections and drop-tank breakaway couplings; self-drain filters for factory compressed-air lines; centralized lubricating systems. **S.B.A.C. Stand 171.**

FAILSWORTH PLASTICS, Claremont Street, Failsworth, Lancs (Proprietors, Failsworth Hats, Ltd.).—A.I.D. approved for flexible aircraft components made from P.V.C.-covered felt; resistant to oil, petrol, glycol, water and heat.

FAIREY AVIATION CO., LTD., Hayes, Middlesex (Hayes 3800).—Plastic components, powered controls; S.B.A.C. standards. (See also under "Aircraft" section.) **S.B.A.C. Stand K.**

FAIRTHORPE, LTD., The Market Place, Chalfont St. Peter, Bucks (Gerrards Cross 3881).—Airframe, engine and airscrew components; all types of machining, including particularly special development work, jig fixtures, form-tools, cutting tools; servicing.

FEENY AND JOHNSON, LTD., 134-136 Ealing Road, Wembley, Middlesex (Wembley 4801-4802).—High-pressure instantly detachable couplings, including 12.000 lb/sq in type for jet starting; ¼in H.P. coupling for hydraulics and oxygen; trailer vacuum brakes; Universal clips, 5/16in to 30ft diam.; air-control conversion units for disabled-driver vehicles.

FENNER AND CO., LTD., J. H., Marfleet, Hull, Yorks (Central 33802). —Manufacturers of V-belts, taper-lock V-pulleys, taper-lock flexible couplings, "Hainsworth" variable-speed drives, solid woven and leather transmission belting, mechanical rubber products.

FIREPROOF TANKS, LTD., The Airport, Portsmouth (Portsmouth 70836-7-8).—Manufacturers of flexible fuel-tanks; crash-resistant, flameproof and self-sealing coverings for flexible and rigid tanks; moulded rubber components for numerous applications. **S.B.A.C. Stand 69.**

FIRESTONE TYRE AND RUBBER CO., LTD., Great West Road, Brentford, Middlesex (Ealing 3456). —Pneumatic tyres and inner tubes for aircraft and for airfield transport. Rubber-to-metal bonded parts, including engine mountings and vibration dampers. **S.B.A.C. Stand 117.**

FISCHER BEARINGS CO., LTD., Wolverhampton (Wolverhampton 26101).—Ball and parallel-roller bearings, miniature bearings; specialists in the manufacture of precision bearings for jet and piston engines.

FLEXIBOX, LTD., Nash Road, Trafford Park, Manchester 17 (Trafford Park 2659).—Mechanical seals for centrifugal and displacement pumps, and for rotary and oscillating shafts, and pipes, in all types of fuel, hydraulic and de-icing systems. A.I.D. approved.

FOLLAND AIRCRAFT, LTD., Hamble, Hants (Hamble 3191).—Design and construction of aircraft;

THE AIRCRAFT INDUSTRY . . .

Aircraft Parts (continued)

ejector seat development and production; component production and experimental work. **S.B.A.C. Stand G.**

FRANCO-BRITISH ELECTRICAL CO., LTD., THE, Aerodrome Road, Colindale Avenue, London, N.W.9 (Colindale 6581). — Aircraft components.

GARRINGTONS, LTD., Bromsgrove, Worcs (Bromsgrove 2621).—Aircraft forgings. Forged blades for gas turbines and compressors, experimental or mass-production, to oversize or precision limits (alternatively, fully machined) in light alloys, aluminium bronzes, stainless steels and nickel or titanium alloys. **S.B.A.C. Stand 218.**

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GOODYEAR TYRE AND RUBBER CO. (GT. BRITAIN), LTD., Aviation Division, Bushbury, Wolverhampton (Wolverhampton 22301), and Wallasey, Cheshire. — Tyres, wheels, disc brakes and associated equipment for civil and military aircraft. Automatic braking systems. Cross-wind castoring wheels. **S.B.A.C. Stand 141.**

GOSHERON AND CO., LTD., JOHN, Gayford Road, London W.12 (Shepherds Bush 3326).—Self-adhesive tapes for sealing, identifying, fastening, warning and instructing, conforming to all A.I.D., M.O.S., and Admiralty current specifications. Tropicalization tapes.

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HADLEY CO., LTD., Portsmouth Road, Surbiton, Surrey (Emberbrook 2710).—Moulders and fabricators of components in plastics and metal; safety goggles and face-masks.

HARDY SPICER, LTD., Birch Road, Witton, Birmingham, 6 (Birchfields 4504).—Needle roller universal joints and drive-shafts for main and auxiliary drives; standard angle and special applications.

HEADLAND, LTD., THOS. P., 164/8 Westminster Bridge Road, London, S.E.1 (Waterloo 5600).—Dzus fasteners, aircraft components, general engineering supplies, ground equipment, torsion wrenches, aircraft and alloy steels.

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HELLIWELLS, LTD., The Airport, Walsall, Staffs (Walsall 4553).—Aircraft component and sheet-metal work; aircraft overhauls and repairs. **S.B.A.C. Stand 31.**

HEPWORTH AND GRANDAGE (YEADON), LTD., Victoria Avenue, Yeadon, Leeds (Rawdon 1225/6).—Turbine rotor and stator blades.

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HOFFMANN MANUFACTURING CO., LTD., Chelmsford, Essex (Chelmsford 3151).—Makers of ball and roller bearings for all types of power units, controls, rudder posts, landing wheels, aircraft carrier lifts and catapult gear.

HYMATIC ENGINEERING CO., LTD., Redditch, Worcs (Redditch 743).—High- and low-pressure pneumatic equipment; compressors, valves, actuators, snap jacks, fuel-system and seal pressurization valves, test rigs. **S.B.A.C. Stand 182.**

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IMPERIAL CHEMICAL INDUSTRIES, LTD. (Plastics Division), Black Fan Road, Welwyn Garden City, Herts (Welwyn Gdn. 3400).—Aircraft components and accessories in "Perspex" acrylic sheet, "Fluon" (polytetrafluoroethylene) and nylon; "Darvic" (rigid p.v.c. sheet). **S.B.A.C. Stand 98.**

INGERSOLL (MANUFACTURING), LTD., South Ruislip, Middlesex (Byron 3456).—Toggle fasteners, locking devices and release slips for all purposes. Clockwork, time-based and allied instruments.

INTEGRAL, LTD., Birmingham Road, Wolverhampton (Wolverhampton 24984).—Aircraft hydraulic equipment, pumps, motors, control valves, and high-precision mechanisms. Electronic fuel flow meters. **S.B.A.C. Stand 172.**

JET TANKS, LTD., 3 Red Place, London, W.1 (Mayfair 9358/9).—Works at London and Shoreham-by-Sea. Designers and manufacturers of non-metallic tanks and other aeronautical components. Production and development engineers in "Durestos" and other laminated and non-metallic materials. (Associated with British Emulsifiers, Ltd., and F. G. Miles, Ltd., q.v.).

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WALTER LAWRENCE AND SON, LTD., Sawbridgeworth, Herts. (Sawbridgeworth 2171).—Metal detail components, jigs, fixtures, machining, jig boring, welding and rubber press tools.

LINDLEY AND CO., LTD., C., Englefield Road, London, N.1 (Clissold 0643).—Manufacturers of precision-turned and cold-headed bolts used in aircraft.

LINREAD, LTD., Cox Street, Birmingham, 3 (Central 3951).—High-tensile aircraft bolts; hexagon slotted and Phillips recessed. Aircraft screws, slotted and Phillips recessed Aircraft rivets; special cold forgings; light presswork.

LOCKHEED HYDRAULIC BRAKE CO., LTD., Leamington Spa (Leam. Spa 2700). — Manufacturers of Lockheed hydraulic aircraft equipment, including hydraulic systems for all types of aircraft; undercarriages and retracting gear; "Servodyne" powered flying controls, hydraulic brake assistance for turbojet engines. **S.B.A.C. Stand 209.**

LUCAS (GAS TURBINE) EQUIPMENT), LTD., JOSEPH, Birmingham, 28 (Springfield 3232).—Research, design, development and manufacture of fuel pumps and systems, hydraulic control systems, combustion equipment, and de-icing heaters. **S.B.A.C. Stand 137.**

MARSTON EXCELSIOR, LTD. (Imperial Chemical Industries, Ltd.), Wobaston Road, Fordhouses, Wolverhampton (Fordhouses 2181).—"Flexelite" flexible tanks for fuel and other applications; light-alloy heat-exchange equipment; sheet-metal fabrication and machine products; radomes, fin tips, aerial housings and ducting, etc., in reinforced plastic laminates. **S.B.A.C. Stand 119.**

METALASTIK, LTD., Evington Valley Road, Leicester (Leicester 37281/2/3/4). — Anti-vibration mountings and devices; flexible mountings for engines, instruments and other components; flexible couplings.

METAL COMPONENTS, LTD., Dolphin Road, Shoreham-by-Sea, Sussex (Shoreham-by-Sea 2224/5).—A.I.D. and A.R.B. approved aircraft plugs and sockets; A.G.S. parts; light metal and fibre pressings; precision machining and small electrical mechanical assemblies.

MIDLAND AEROQUIPMENT, LTD., Bloxwich, Staffs (Bloxwich 66414).—Door locks and fastenings.

MILES, LTD., F. G. (Plastics Division), Shoreham Airport, Sussex (Shoreham-by-Sea 2301). — Structural plastics engineers: development and production of moulded plastics radar aerials, radomes and aircraft components.

MILES, LTD., F. G., Shoreham Airport, Sussex (Shoreham-by-Sea 2301).—Designers and constructors of prototype aircraft; manufacturers of jigs, tools, components and sub-assemblies; designers and manufacturers of optical inspection equipment.

MOLLART ENGINEERING CO., LTD., Kingston By-Pass, Surbiton, Surrey (Elmbridge 3352).—M.E. patent and Hooke's type universal joints; precision-machined aircraft components; horizontal and vertical comparators; Medigraph perspective drawing instrument. **S.B.A.C. Stand 92.**

MOUNTFORD (BIRMINGHAM), LTD., FREDK., Fremo Works, Moseley Street, Birmingham, 5 (Midland 3488/9).—Aircraft taper pins (solid and split), stainless-steel bolts, screws, nuts, etc., special repetition components.

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OPPERMAN, LTD., S. E., Stirling Corner, Boreham Wood, Herts (Elstree 2021).—Gears, gear boxes and components for aircraft and engines.

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PALMER TYRE, LTD., THE, Herga House, Vincent Sq., London, S.W.1 (Victoria 8323).—Aircraft and helicopter tyres, wheels and disc brakes. New type Silvoflex high-pressure hose for hydraulic controls and pressure fuel systems. Actuators, reducing valves, toe-pedal brake units, helicopter pontoons, toe straps, inspection hole covers, pigged matting, etc. **S.B.A.C. Stand 158.**

PERFECTA MOTOR EQUIPMENTS, LTD., Oxford Street, Birmingham 5 (Midland 1673).—Manufacturers of aircraft canopies, windscreens, emergency exits, miscellaneous ejector-seat sub-assemblies, light alloy and steel presswork.

PETRO-FLEX TUBING CO., LTD., Cassiobury Works, St. Albans Road, Watford, Herts (Watford 6044). —Manufacturers of flexible hose, A.G.S. parts, special fittings, etc.

PHILIDAS, LTD. (Division of Whitehouse Industries, Ltd.), Great North Road, Ferrybridge, Yorks (Knottingley 320 .—Manufacturers of the Philidas self-locking nut, fully approved by A.I.D. and A.R.B. **S.B.A.C. Stand 237.**

PIONEER OILSEALING AND MOULDING CO., LTD., Cottontree Works, Colne, Lancashire (Wycoller 411/2). — Manufacturers of every type of synthetic rubber O-ring and oil-seal. A.I.D. and A.R.B. approved.

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POWER FLEXIBLE TUBING CO., LTD., Derby Works, Vale Road, London, N.4 (Stamford Hill 6696).—Flexible assemblies, including stainless-steel flexible metallic tubing and fittings, stainless steel bellows and expansion joints.

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PRECISION RUBBERS, LTD., Bagworth, Leicestershire (Bagworth 241).—Specialists in natural and synthetic rubber components for airframes, engines, fuel and hydraulic systems, etc. A.I.D. and A.R.B. approved. **S.B.A.C. Stand 88.**

PRECISION UNITS (DORSET), LTD., 9, Fortescue Road, Bournemouth, Hants (Parkstone 1664) and Seacrest Works, Church Road, Parkstone, Dorset. — Machine-engraved nameplates and labels in metal, plastics, etc.

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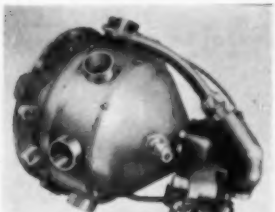
RAWLPLUG CO., LTD., THE, London, S.W.7 (Frobisher 8111).—Patented Rawlplug devices for making blind fixings in aircraft. Other Rawlplug fixing devices and tools for use in aircraft factories. **S.B.A.C. Stand 247.**

REDWING, LTD., 340, Bensham Lane, Thornton Heath, Croydon (Thornton Heath 3663).—Airframe structures; components, light-alloy presswork and light machine work. **S.B.A.C. Stand 233.**



Rotax fuel/air starter (see Rotax, Ltd., under "Electrical" and in review preceding this directory).

RILEY, LTD., ROBERT, Milkstone Spring Works, Rochdale (Rochdale 2237).—Springs for all aircraft purposes. Specialists in beryllium copper springs. On Admiralty, War Office and Air Ministry lists; A.R.B. approved.

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ROSS, COURTNEY AND CO., LTD., Ashbrook Road, London, N.19 (Archway 1166).—Terminals, tags, wire ends, repetition turned parts, presswork, aircraft general stores.

ROTHERHAM AND SONS, LTD., Coventry (Coventry 64154).—A.G.S. components (pipe couplings, etc.); pressure-gauge movements; time-delay mechanisms; petrol and drain taps.

ROTOL, LTD., Cheltenham Road, Gloucester (Gloucester 24431).—Variable-pitch airscrews, accessory drive and engine synchronization equipment, air turbine motors and ram-air turbine drives. **S.B.A.C. Stand 53.**

RUBBAGLAS, LTD., 245, Vauxhall Bridge Road, London, S.W.1 (Victoria 6501).—"Rubbaglex" sheeting and gaskets, glass-based, chemical- and fire-resistant.

RUBERY, OWEN AND CO., LTD., Darlaston, South Staffs (Darlaston 130).—Aircraft standard parts; bolts and nuts to all aircraft specifications; aircraft sub-assemblies and pressings. **S.B.A.C. Stand 17.**

S.U. CARBURETTER CO., LTD., Erdington, Birmingham (Erdington 2150).—Piston-engine fuel-injection pumps and associated equipment. A.I.D. and A.R.B. design approval.

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SAUNDERS VALVE CO., LTD., Cwmbran, Monmouthshire; Aircraft Division: Blackfriars Street, Hereford (Hereford 3088).—Cocks and valves for control of all aircraft fluids. Diaphragm valves for ground installations. **S.B.A.C. Stand 142.**

SELF-PRIMING PUMP AND ENGINEERING CO., LTD., Trading Estate, Slough, Bucks (Slough 23277).—Electrically and air-turbine-driven fuel booster pumps, cabin heater pumps, water/methanol injection pumps, hand-operated priming pumps, fuel recuperators, inverted flight valves, non-return valves, float valves, airflow regulator valves, etc. **S.B.A.C. Stand 65.**

SERCK RADIATORS, LTD., Warwick Road, Birmingham 11 (Victoria 0531). — Heat-exchange equipment for piston and gas turbine power plants on aircraft and land installations, and for presses and machine tools.

SETON CREAGHE ENGINEERING, LTD., Trading Estate, Park Royal, London, N.W.10 (Elgar 5257). —Prototype assemblies, mechanical and electro-mechanical.

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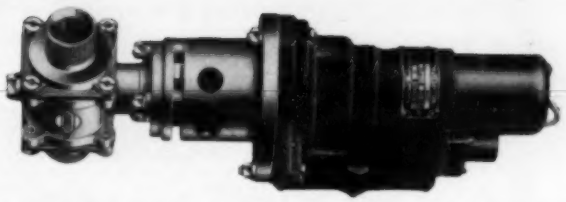
SIMMONDS AEROCESSORIES, LTD., Treforest, Pontypridd, Glamorgan (Treforest 2211).—Pacitor fuel gauges, Nyloc stiffnuts. Spire fasteners. **S.B.A.C. Stand 170.**

SKEFKO BALL BEARING CO., LTD., Luton, Beds (Luton 5700).—All four basic types of rolling bearings (ball, cylindrical, taper and spherical roller), power transmission equipment, ball-bearing aircraft control pulleys and rubber tyred rollers.

SMART AND BROWN (MACHINE TOOLS), LTD., 25 Manchester Square, London, W.1 (Welbeck 7941/6). — Precision-machined detail work and assemblies for armament, aircraft and engine components; fluorescent lighting; designers and manufacturers of precision lathes and toggle presses. M.o.S. contractors, A.I.D. and A.R.B. approved.



Saunders spherical plug cock, metallized type, for control of hot air and fluids (motorized model).

SPENCER, MOULTON AND CO., LTD., GEORGE, 13/14, Ashley Place, London, S.W.1 (Victoria 1864).—Rubber-to-metal bondings, mouldings (rubber, neoprene, Silastic), hoses, rubber springs.

STANDARD INSULATOR CO., LTD., Bridge Road, Camberley, Surrey (Camberley 1813).—Moulded rubber grommets to B.S.S. S.P.40, complete range, in addition to standard range of 500 sizes in natural and synthetic grades. Standard patent double-turn hose clips with universal application. Standard Loyd auto rotary sickle for cutting vegetation. **S.B.A.C. Stand 256.**

J. STONE AND CO. (DEPTFORD), LTD., London, S.E.14 (Tideway 1202).—Specialists in the production of standard and close-tolerance rivets. Electrical equipment, including lightweight automatic voltage regulators. **S.B.A.C. Stand 236.**

SUNTEX SAFETY GLASS INDUSTRIES, LTD., Iver, Bucks (Iver 11/12). — Aircraft canopies, cockpit covers and all vision panels in Perspex, clear and tinted. Bird-resistant and bullet-resistant safety-glass; day/night flying training window panels. **S.B.A.C. Stand 131.**

SUPER OIL SEALS AND GASKETS, LTD., King's Norton, Birmingham (King's Norton 2041-7).—Manufacturers of oil seals, high-precision mechanical mouldings in natural and synthetic rubber, and high-pressure hose. British licensees for "Aeroquip" flexible hoses and detachable, re-usable end fittings. **S.B.A.C. Stand 79.**

T.K.S. (AIRCRAFT DE-ICING), LTD., Drayton House, Gordon Street, London, W.C.1 (Euston 4650).—Research, design and manufacture of aircraft de-icing equipment. **S.B.A.C. Stand 59.**

TEDDINGTON CONTROLS, LTD., Merthyr Tydfil, South Wales (Merthyr 666).—Aircraft temperature- and pressure-control equipment; time and sequence switches; hot-air valves, some operating up to 700 C; electro-magnetic valves; fuel-tanking pressurization equipment. **S.B.A.C. Stand 45.**

TELEFLEX PRODUCTS, LTD., High Road, Chadwell Heath, Essex (Seven Kings 5771). — Mechanical remote-control equipment for aircraft; engine test-bed control equipment. **S.B.A.C. Stand 217.**

TENAPLAS (SALES), LTD., Upper Basildon, nr. Pangbourne, Berks (Upper Basildon 333).—Extruders of polythene tubing, mouldings, P.V.C. extruded sections, tubes, tapes, sleevings, markers.

TERRY AND SONS, LTD., HERBERT, Redditch, Worcs (Redditch 61).—Springs, presswork, flexible shafts, Anglepoise lamps, security worm-drive hose clips.

THERMO - PLASTICS, LTD., Luton Road Works, Dunstable, Beds (Dunstable 686). — Moulders and fabricators of all plastic materials; radomes, glass fabric and asbestos laminates, canopies, hoods, etc. **S.B.A.C. Stand 52.**

TRIST AND CO., LTD., RONALD, Bath Road, Slough, Bucks (Slough 20222).—SEATRIST packings and seals and special-purpose rubber and synthetic-rubber products, used particularly in hydraulic systems; MOBREY magnetic level switches for liquid-level control on ground installations.

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TUFNOL, LTD., Perry Bar, Birmingham 22B (Birchfields 4554).—Tufnol parts for aircraft, including pulleys, fairleads, gears, bearings and electrical insulators. Also jigs and Tufnol sheets, tubes and rods. **S.B.A.C. Stand 210.**

UHLHORN BROS., LTD., 53 City Road, London, E.C.1 (Clerkenwell 0145/9).—Machinists and fabricators of aircraft components in all plastic and allied materials.

VOKES, LTD., Guildford, Surrey (Guildford 62861).—Air-intake, fuel, lubricating and hydraulic-oil filters; filters and silencers for cabin air control. Test bed filters. **S.B.A.C. Stand 115.**

V.P. SHEET METAL, LTD., Windsor Street, Cheltenham (Cheltenham 5805-6). — Sheet-metal components, jet-engine combustion equipment, fabrication, presswork and machining in light alloys and heat-resisting materials. Experimental and production.

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WARWICK PRODUCTION CO., LTD., Birmingham Road, Warwick (Warwick 693).—Sub-assemblies in aluminium and steel; also pressing, spinning, welding, riveting, electro-polishing, plating, anodizing, etc.

WELLWORTHY, LTD., Lymington, Hants (Lymington 520).—Sealing rings for jet engines; Al-Fin bimetallic assemblies; pistons and rings; jointing compound; aluminium die castings. **S.B.A.C. Stand 122.**

WELSH METAL INDUSTRIES, LTD., Caerphilly, Glamorgan (Caerphilly 2282).—Airframe structures, components, light-alloy presswork. A.I.D. and A.R.B. approved.

WESTERN MANUFACTURING (READING), LTD., The Aerodrome, Reading, Berks (Sonning 2351).—Designers and manufacturers of electrical and pneumatic actuators, trim switches, limit switches, fractional h.p. motors and stall-warning devices. Sub-contractors for aircraft structures. **S.B.A.C. Stand 181.**

WESTMINSTER AIRWAYS SERVICING, LTD., Priory Road, Gosport. — Precision engineering; jig-boring; aircraft jigs and tools; components; sub-assemblies; prototype and experimental work.

WESTON AND CO., LTD., CHARLES, Irwell Bank Works, Douglas Green, Pendleton, Salford, 6 (Pendleton 2857). — A.I.D. and A.R.B. approved. Weston synthetic rubber and leather seals, "O" rings and mouldings. Impax face-type seal.

WEYBURN ENGINEERING CO., LTD., Elstead, Godalming, Surrey (Elstead 2141-2-3).—Camshafts, and precision components for aircraft.

THE AIRCRAFT INDUSTRY . . .

Aircraft Parts (continued)

WILLCOX AND CO., LTD., W. H., Aviation Section, Southwark House, Southwark Street, London, S.E.1 (Hop 8022).—Willcox universal joints, A.I.D. approved; non-rubber petrol hose; vee-ropes; packings and jointings for petrol, oils, etc.

WILLIAMS AND JAMES (ENGINEERS), LTD., Chequers Bridge, Gloucester (Gloucester 24021-2-3).—A.I.D. and A.R.B. approved. Machining of aircraft components; manufacturers of compressed air, vacuum and hydraulic equipment for ground servicing.

WILLIAMSON AND CO., LTD., W. AND A., 16/24 Brewery Road, Islington, London, N.7 (North 4411/7). — Associate company of British Emulsifiers, Ltd., *q.v.* **S.B.A.C. Stand 206.**

ELECTRICAL

(Including Radio, Radar and Electronics)

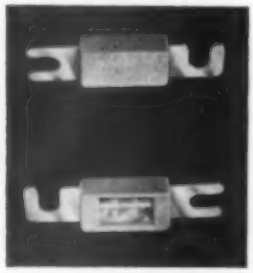
A.T.&E. (BRIDGNORTH), LTD., Strowger House, 8 Arundel Street, London, W.C.2 (Temple Bar 9262). —Single-channel fixed and mobile V.H.F. networks; V.H.F. multi-channel systems; radio telegraph terminal equipment.

AIRMEC, LTD., High Wycombe, Bucks (High Wycombe 2060).—Aircraft intercommunication equipment, electronic test instruments, high frequency induction heating equipment, power transformers.

AMALGAMATED WIRELESS (AUSTRALASIA), LTD.—Australian Associates of Marconi's Wireless Telegraph Co., Ltd., *q.v.* **S.B.A.C. Stand 38.**

ANTICOUSTIC CO., 204 High Street, Guildford, Surrey (Guildford 66488).—Sound-insulating telephone headsets for ground or aircrew ("Nosonic" type TX can be fitted with most existing phone inserts).

BELLING AND LEE, LTD., Great Cambridge Road, Enfield, Middlesex (Enfield 3322). — Electronic components for communication and navigational aids, radar, etc. Aircraft fuses. **S.B.A.C. Stand 249.**



Fuses for use on 30-volt circuits (35-275 amp), by Belling and Lee.

BONNELLA AND SON, LTD., D. H., West Hill, Hoddesdon, Herts (Hoddesdon 81).—Aircraft navigation and identification lamps and glasses; switches, fuses, fuse boxes, terminal blocks, plugs, sockets, A.G.S. parts.

BOOSEY AND HAWKES (ENGINEERS), LTD., Sonorous Works, Edgware, Middlesex (Edgware 5581). — Magnetic recorders (tape and wire), including special crashproof 24-volt aircraft model and battery-operated air travellers' tape recorder.

BRITISH INSULATED CALLENDER'S CABLES, LTD., 21 Bloomsbury Street, London, W.C.1 (Museum 1600).—Manufacturers of all types of aircraft wiring cables, also connecting wires, sleevings and miniature multi-way instrument cables; electric cables for airport installations. **S.B.A.C. Stand 159.**

BRITISH THOMSON-HOUSTON CO., LTD., Alma Street, Coventry (Coventry 64181).—Electrical equipment for aircraft, including turbo-starters; high-energy ignition units; booster coils; A.C. and D.C. motors and generators; magnetos; auxiliary generating plant; rectifiers; switches; circuit-breakers; voltage regulators; electronic engine testers. Mazda lamps and lighting equipment. **S.B.A.C. Stand 213.**

BURGESS PRODUCTS CO., LTD., Dukesway, Team Valley, Gateshead-on-Tyne (Low Fell 75322). —Miniature automatic re-setting snap-action change-over switches, A.I.D. and A.R.B. approved. **S.B.A.C. Stand 258.**

BURNDEPT, LTD., West Street, Erith, Kent (Erith 3080).—Radio telecommunications V.H.F. and U.H.F. equipment; electronic equipment; dinghy transmitters; dry batteries of all types for Service equipment. **S.B.A.C. Stand 260.**

CANADIAN MARCONI CO. — Associates of Marconi's Wireless Telegraph Co., Ltd., *q.v.* **S.B.A.C. Stand 39.**

CHELTON (ELECTROSTATICS), LTD., Marlow, Bucks (Marlow 1063/4). — "Driwik" static dischargers; aircraft aerial masts and insulated aerial equipment; precision injection mouldings; resin-bonded glass laminates.

CHLORIDE BATTERIES, LTD., Exide Works, Clifton Junction, Swinton, Manchester (Manchester Swinton 2011).—Exide lightweight batteries for all civil and Service aircraft and heavy-duty ground starting units. **S.B.A.C. Stand 143.**

CLANG, LTD., Cricklewood, London, N.W.2 (Gladstone 4201).—Manufacturers of aircraft accessories 5C, 5D, 10H, etc. A.I.D. and A.R.B. approved plugs and sockets, Jones type, co-axial; W. and M. switches, terminal blocks.

COLE, LTD., E. K., Southend-on-Sea, Essex (Southend 49491).—Ekco airborne search radar; Ekco airfield approach aid; V.H.F. aircraft communications equipment; suppressed aerial systems; electronic and nucleonic equipment. **S.B.A.C. Stand 185.**

COSSOR RADAR, LTD., Highbury Grove, London, N.5 (Canonbury 1234).—Primary and secondary radar equipment; miniature Gee airborne navigation equipment; instruments for industrial test. **S.B.A.C. Stand 63.**

CRABTREE AND CO., LTD., J. A., Lincoln Works, Walsall, Staffs (Walsall 2202-7). — Wiring-system components for aircraft and airfield electrical installations.

DECCA NAVIGATOR CO., LTD., 1-3, Brixton Road, London, S.W.9 (Reliance 8111). — Patentees and manufacturers of the Decca Navigator system of navigation; Flight Log and airborne receiving equipment. **S.B.A.C. Stand 28.**

EASTERN AERO ELECTRICAL SERVICES, LTD., 62 Priory Street, Colchester (Colchester 6173/4). — Overhaul and repair and/or modification of all types of aircraft ignition, electrical and electro-pneumatic equipment; B.T.-H. service agents. **S.B.A.C. Stand 222.**

THE EDISON SWAN ELECTRIC CO., LTD., 155 Charing Cross Road, London, W.C.2, and branches (Gerrard 8660).—Lamps; lighting equipment; cables; valves and cathode-ray tubes; electronic equipment; batteries; battery chargers and special rectifiers; radio and electronic components; electric wiring accessories.

ELECTRICAL ENGINEERING CONSTRUCTION CO., LTD., Totnes, Devon (Totnes 3282).—Self-propelled aircraft starting and servicing units.

ELECTRICAL AND REFRIGERATION SERVICES, LTD., 159 Brookwood Road, London, S.W.18 (Putney 3402-3).—Manufacturers of radio connectors, junction boxes, aerial kits, remote control units, insulator assemblies and similar components.

FRIGIDAIRE DIVISION OF GENERAL MOTORS, LTD., Stag Lane, Kingsbury, London, N.W.9 (Colindale 6541). — Designers and manufacturers of "Delco" D.C. electric motors for use on aircraft, and of rotary transformers.

GOODMANS INDUSTRIES, LTD., Axiom Works, Wembley, Middx. (Wembley 1200).—Electromagnetic vibration generators and associated electronic equipment; special transformers for aircraft equipment. **S.B.A.C. Stand 110.**

GREENWOOD, LTD., P. W., 62 Shirland Road, Willesden, London, W.9 (Cunningham 4422). — A.I.D. and A.R.B. approved stockists of instruments and electrical accessories and components.

HARLEY AIRCRAFT LANDING LAMPS, St. Neots, Huntingdonshire (St. Neots 230).—Aircraft landing lamps; taxying and manoeuvring lamps; passenger reading lamps; leading-edge de-icing lamps; mobile floodlighting equipment. **S.B.A.C. Stand 10.**

HARTLEY ELECTROMOTIVES, LTD., Monkmoor, Shrewsbury, Shropshire (Shrewsbury 6343). — Special-purpose electronic and prefabricated wiring equipment for commercial and Government-contract use.

HENDREY RELAYS, LTD., 392 Bath Road, Slough, Bucks (Burnham 609/610).—A.I.D. and A.R.B. approved relays, types S, T, 9B, etc. Research and test facilities available. Design approval held for relays and control panels.

HENLEY'S TELEGRAPH WORKS CO., LTD., W. T., 51/53 Hatton Garden, London, E.C.1 (Chancery 6822).—Aircraft cables of all types, including H.F. cables, connection wires for electronic apparatus, winding wires, flexible cords and electric soldering irons. **S.B.A.C. Stand 146.**

K.L.G. SPARKING PLUGS, LTD., Putney Vale, London, S.W.15 (Enquiries to Gladstone 3333).—Jet thermo-couple harness installation, thermocouples, high-energy surface-discharge igniters, sparking plugs, igniter plugs and ignition harness accessories. **S.B.A.C. Stand 4.**

LODGE PLUGS, LTD., St. Peter's Road, Rugby, Warwickshire (Rugby 2076).—Aircraft sparking plugs of all types. High-energy igniter plugs and cable sleeves. Servicing and testing equipment, including the new chemical cleaner. **S.B.A.C. Stand 116.**

LONDEX, LTD., Anerley Works, 207, Anerley Road, London, S.E.20 (Sydenham 6258).—Manufacturers of relays, process timers and automatic electrical apparatus. Co-axial and other relays for aircraft use.

M.H.H. ENGINEERING CO., LTD., Bramley, nr. Guildford, Surrey (Bramley 2248).—Torsion wrenches, high-pressure-air regulators, A.G.S. components, electro-hydraulic equipment and electrical switchgear. **S.B.A.C. Stand 27.**

McMICHAEL RADIO, LTD., Equipment Division, Slough, Bucks (Slough 24541).—Radio, electronic and electrical aircraft equipment and ancillaries. Precision electronic research instruments for airborne and ground laboratory use. **S.B.A.C. Stand 47.**

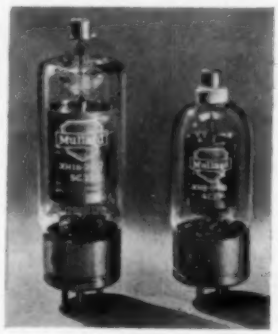
MAGNETIC DEVICES, LTD., Exning Road, Newmarket, Suffolk (Newmarket 3181-2-3). — Electromagnetic relays for aircraft, radio and industrial application.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Chelmsford, Essex (Chelmsford 3221).—Airport and airborne wireless installations covering a full range of communication, navigational and inter-communication equipment. **S.B.A.C. Stand 37.**

MORGAN CRUCIBLE CO., LTD., THE, Battersea Church Rd., London, S.W.11 (Battersea 8822).—A.I.D. and A.R.B. approved for electrical brushes, including high-altitude and actuator gear types; electrical contacts; carbon glands, seals, bearings, etc.; sintered-metal bearings.

MULLARD, LTD., Communications and Industrial Valve Department, Century House, Shaftesbury Avenue, London, W.C.2 (Gerrard 7777).—Radio valves, cathode-ray tubes and special electronic devices for communications, navigational and other electronic equipment. **S.B.A.C. Stand 223.**

MULLARD, LTD., Equipment Division, Century House, Shaftesbury Avenue, London, W.C.2 (Gerrard 7777).—Radio and telephone communications equipment; electronic instrumentation; aluminium soldering equipment; electronic meteorological apparatus (radar sondes). **S.B.A.C. Stand 126.**



Mullard hydrogen thyratrons for radar transmitters.

MURPHY RADIO, LTD., Welwyn Garden City, Herts (Welwyn Garden 800).—Radio and radar communication and navigational equipment for aircraft and ground stations, including distance-measuring equipment, radar beacons, V.H.F. transmitter/receivers, passenger announcement systems and voltage regulators. **S.B.A.C. Stand 203.**

NEWMAN INDUSTRIES, LTD., Yate, Bristol (Chipping Sodbury 3311).—Electric motors up to 200 h.p.; machine tools, all types; ferrous and non-ferrous castings.

NEWTON BROTHERS (DERBY), LTD., Alfreton Road, Derby (Derby 47676).—Lightweight aircraft electrical equipment; automatic voltage regulators; rotary transformers and convertors; aircraft generators; high-frequency alternators. **S.B.A.C. Stand 214.**

NIFE BATTERIES, Redditch, Worcs. (Redditch 157). — Nickel-cadmium alkaline batteries for emergency cockpit lighting and for all ground service.

OLDHAM AND SON, LTD., Denton, Manchester (Denton 2431).—Aircraft batteries of maximum capacity-to-weight ratio and unspillable. Types for aircraft and ground starting and lighting. Safety hand lamps, etc. **S.B.A.C. Stand 231.**

OLIVER PELL CONTROL, LTD., Cambridge Row, Woolwich (Woolwich 1422).—Specialists in electro-magnets; design and manufacture of coils, transformers, solenoids and relays to customers' requirements.

PAINTON AND CO., LTD., Kingsthorpe, Northampton (Northampton 32354-5).—Electrical and electronic equipment components, including wirewound and high-stability carbon resistors; plugs and sockets; switches; wirewound potentiometers; knobs, dials and pointers.

PARTRIDGE WILSON AND CO., LTD., Davenset Electrical Works, Leicester (Leicester 37291).—Manufacturers of "Davenset" ground starting and servicing rectifiers and other mains-operated rectifiers.

PETO AND RADFORD, 137, Victoria Street, London, S.W.1 (Sloane 7164).—"Dagenite" batteries fitted with Porvic separators, polythene connector covers and vents, for all types of aircraft; ground starting units. **S.B.A.C. Stand 155.**

AN OUTSTANDING CONTRIBUTION TO BRITAIN'S LEAD IN JET AIRCRAFT DEVELOPMENT

Esso Aviation Turbo Oil 35

STILL the only lubricant in step with British jet engine design, ESSO Aviation Turbo Oil 35, the synthetic lubricating oil evolved by Esso Research Teams in Britain, is the only oil approved for the high-thrust jet engines developed in the past few years.

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THE AIRCRAFT INDUSTRY . . .

Electrical (continued)

PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2 (Gerrard 7777).—Tungsten, fluorescent, blended and discharge lamps and lighting equipment; special fluorescent lighting for aircraft; high-frequency-heating generators; industrial X-ray equipment: arc and resistance welding plant; measuring instruments; battery chargers; sound-amplification installations. **S.B.A.C. Stand 227.**

PLESSEY GROUP, Ilford, Essex (Ilford 3040) (The Plessey Co., Ltd., Plessey International Ltd., The Wireless Telephone Co., Ltd.).—Liquid-fuel starters; actuators; fuel, de-icing and non-inflammable-fluid pumps; fuel-control systems; crimping tools, magnetic indicators; rotary transformers; hydraulic power packs; tachometers; calibrators, digital computors; F.S.K. teleprinter terminals; de-icing and wiring systems; v.h.f. and h.f radio communications; electronic equipment. **S.B.A.C. Stands 238, 239, 240.**

PRECISION COMPONENTS (BARNET), LTD., 13 Byng Road, Barnet, Herts (Barnet 6867).—Trade name "KABI." Connector blocks; 12-way terminal strips; plastic bench assembly trays; plastic storage trays and bins.

PYE, LTD., Cambridge (Cambridge 3434).—V.H.F. radio equipment for ground-to-air control of aircraft and local control of mobiles, with selective calling facilities and single-channel and multiplex links; radio equipment for long range intercommunication; scientific instruments; plugs; sockets; relays. **S.B.A.C. Stand 35.**

RACAL ENGINEERING, LTD., Bracknell, Berks.—Manufacture of radio communications and navigational aid equipment. Radio-vehicle fitting.

RADIO-AIDS, LTD., 29 Market Street, Watford, Herts. (Watford 5988).—V.H.F. communications test-sets, special electronic equipment to individual requirements, quartz crystals. A.I.D. and A.R.B. approved.

REDIFON, LTD., Broomhill Road, London, S.W.18 (Vandyke 7281).—M.F., H.F. and V.H.F. ground and mobile radio communication and navigational equipment. Flight simulators for aircrew training. **S.B.A.C. Stand 8** (and outdoor exhibit).

ROTAX, LTD., Willesden Junction, London, N.W.10 (Elgar 7777).—Aircraft electrical and starting systems, both A.C. and D.C.; inverters; linear and rotary actuators, including undercarriage actuators; de-icing equipment and switchgear; electric and fuel/air starters for reciprocating and gas turbine engines. **S.B.A.C. Stand 138.**

SAUNDERS-ROE, LTD. (Electronics Division), East Cowes, Isle of Wight (Cowes 2211).—Saunders-Roe/Technograph foil strain-gauges; electronic research and test equipment, including displacement indicators and computor amplifiers. **S.B.A.C. Stand 144.**

SCINTILLA, LTD., 20 Carlisle Road, The Hyde, Hendon, London, N.W.9 (Colindale 8844).—Manufacturers of camshaft-speed Vertex magnetos and Lesto portable electrical tools. Repairs to aircraft electrical equipment, including Scintilla Bendix magnetos.

STANDARD TELEPHONES AND CABLES, LTD., Connaught House, 63 Aldwych, London, W.C.2 (Holborn 8765).—Airborne and ground radio communication and navigation equipment; airfield lighting remote control equipment; SenTerCel rectifier stacks and germanium devices; portable S.H.F. communication links; quartz crystals; magnetic materials; radio interference suppressors; thermistors. **S.B.A.C. Stands 193, 194.**

SUPLEX LAMPS, LTD., Suplex House, 239, High Holborn, London, W.C.1 (Holborn 0225 and 4543).—Aircraft lamp filaments, landing lamps, fuses and other ancillaries, British and American types.

TECHNOGRAPH PRINTED CIRCUITS, LTD., 32 Shaftesbury Avenue, London, W.1 (Gerrard 4532).—Anti-icing circuits for any structure; temperature-sensing circuits; foil strain-gauges; etched-foil wiring; slip-ring assemblies; fuses and micro-fuses; and foldable and rigid circuits for all purposes.

THERMIONIC PRODUCTS, LTD., Hythe, Southampton (Hythe 3265). — Thermionic multi-channel airport recorder for air traffic control monitoring. Quartz crystal units manufactured by Brush Crystal Co., Ltd. (associated company), showing on **S.B.A.C. Stand 179.**

THORN ELECTRICAL INDUSTRIES, LTD. (Aircraft Components Division), 105-109 Judd Street, London, W.C.2 (Euston 4433).—Thorn Plasteck console panel illumination; aircraft navigation and interior lighting; sealed relays and circuit breakers; factory and airport lighting schemes. **S.B.A.C. Stand 244.**

TROUP, CURTIS AND CO., LTD., 282 Victoria Dock Road, London, E.16 (Albert Dock 2417).—A.I.D. and A.R.B. approved for repairs and overhauls of aircraft electrical equipment.

ULTRA ELECTRIC, LTD., Western Avenue, Acton, London, W.3 (Acorn 3434).—Gas turbine and turboprop engine electric-controller systems; "Sarah" air/sea rescue equipment; communication control equipment. **S.B.A.C. Stand 135.**

VARLEY DRY ACCUMULATORS, LTD., By-pass Road, Barking, Essex (Rippleway 3346).—Lightweight, high-efficiency batteries for aircraft and ground starting.

VENNER ACCUMULATORS, LTD., Kingston By-Pass, New Malden, Surrey (Malden 2442).—Lightweight silver-zinc accumulators, one-sixth the weight and one-fifth the size of other accumulators of equivalent capacity. **S.B.A.C. Stand 90.**

Automatic typewriter operating from output stages of computing machinery (Saunders-Roe, Ltd.).

Emergency lighting unit for cabin roof (Venner).

VENNER, LTD., Kingston By-Pass, New Malden, Surrey (Malden 2442). — Magnetic relays, morse-code sender, aircraft emergency lighting unit, time-delay switches, timing equipment. **S.B.A.C. Stand 89.**

WALTERS ELECTRICAL MFG. CO., LTD., 249 Kensal Road, W.10 (Ladbroke 2323/4).—Stewards call systems, illuminated press-switches, illuminated passenger - warning notices, radio operators' morse keys, electrical apparatus, lighting, etc.

WESTINGHOUSE BRAKE AND SIGNAL CO., LTD., 82 York Way, King's Cross, London, N.1 (Terminus 6432).—Metal rectifiers, engine starters and ground power units, lightweight rectifiers for aircraft power supplies, automatic broadcast announcer. **S.B.A.C. Stand 15.**

WIRELESS TELEPHONE CO., LTD., Hallamgate Works, Crookes Road, Sheffield 10. — See under "Plessey Group." **S.B.A.C. Stand 240.**

AIRCRAFT INSTRUMENTS

A.J.W. (INSTRUMENTS), LTD., Gatwick Airport, Horley, Surrey (Horley 1420 and 1510, Ext. 38 and 105).—Overhaul and supply of all types of aircraft instruments, gyro-pilot installations, etc.

BRYANS AEROQUIPMENT, LTD., Willow Lane, Mitcham, Surrey (Mitcham 1607).—Designers and manufacturers of test equipment for flight and engine instruments; cabin pressurization equipment and oxygen-demand regulators. **S.B.A.C. Stand 64.**

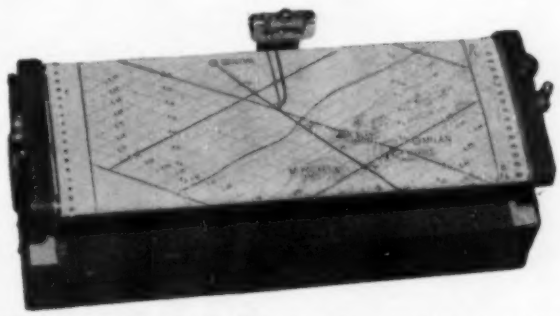
COUNTING INSTRUMENTS, LTD., 5 Elstree Way, Boreham Wood, Herts (Elstree 1382). — Mechanical and electro-magnetic counters; special types available for use in conjunction with aircraft instruments.

LONDON NAME PLATE MFG. CO., LTD., 25 Victoria Street, London, S.W.1 (Abbey 7381).—"Douglas" protractor and other navigational aids.

MECHANISM, LTD., George Street, Croydon, Surrey (Croydon 4240 and 2144).—M.O.S., A.I.D., A.R.B. inspection and design approved. Flight instruments and associated precision electro-mechanical control devices. **S.B.A.C. Stand 255.**

R. W. MUNRO, LTD., Bounds Green, London, N.11 (Enterprise 4422).—Airspeed indicators and calibrators; instruments using anerold and other diaphragms in connection with controlled flight; airport anemometers.

NEGRETTI AND ZAMBRA, LTD., 122 Regent Street, London, W.1 (Regent 3406).—Manufacturers of aeronautical, meteorological and industrial instruments — fuel-flow meters, pressure gauges, thermometers, etc. **S.B.A.C. Stand 205.**



Display head of the Mk 01 Flight Log (Decca Navigator Co., Ltd.).

ELLIOTT BROS. (LONDON), LTD., Century Works, London, S.E.13 (Tideway 3232).—Automatic pilot for Jindivik pilotless aircraft; automatic stabilizers for high-speed aircraft; accelerators, tachometers, torque motors; gyroscopic test gear microwave instruments, "X" and 8-9 mm. band; aircraft and instrument repairs. **S.B.A.C. Stand 147.**

FERRANTI, LTD., Hollinwood, Lancashire (Failsworth 2000); Moston, Manchester, 10 (Failsworth 2271 and 2071); Crew Toll, Edinburgh, 5 (Granton 89181).—Ferranti aircraft simulators, airstream direction indicators, Mk 4B and Mk 5 gyroscopic gunsights, electronic digital computers, high-speed tape readers, electric gyro-horizon Mk 4. **S.B.A.C. Stand 190.**

KELVIN AND HUGHES (AVIATION), LTD., New North Road, Barkingside (Hainault 2601), and Winchester Road, Basingstoke (Basingstoke 690). — Navigational, flight and engine instruments, including sextants, compasses, turn-and-slip indicators, altimeters. **S.B.A.C. Stand 3.**

KENT, LTD., GEORGE, Biscot Road, Luton (Luton 2440).—Aircraft fuel-flow meters; oil and petrol meters for refuellers. **S.B.A.C. Stand 43.**

PULLIN AND CO., LTD., R. B., Phoenix Works, Great West Road, Brentford, Middlesex (Ealing 0011-3 and 3661-3).—Electrical and electronic engineers; scientific-instrument manufacturers; specialists in gyroscopic apparatus. Aircraft equipment includes electrical turn-and-slip indicators, dimmer switches, "S" type magnetic relay switches, etc.

REID AND SIGRIST, LTD., Braunstone Works, Braunstone, Leicester (Leicester 88101-4).—Designers and manufacturers of aeronautical instruments, specializing in gyroscopic instruments and test equipment, and electronic balancing equipment.

SALFORD ELECTRICAL INSTRUMENTS, LTD., Silk Street, Salford, Lancs (Blackfriars 6688).—Quartz crystal units and test gear, radio compass, radio altimeter, radiosonde and ground station; metal rectifiers; Gecalloy cores; all types of instruments. **S.B.A.C. Stand 104.**

SANGAMO WESTON, LTD., Enfield, Middlesex (Enfield 3434).—

THE AIRCRAFT INDUSTRY . . .

Aircraft Instruments (continued)

Electrical instruments for power, temperature, pressure and movement indication, navigational aids, ground test-sets, tachometer, icing detector and servo potentiometer. **S.B.A.C. Stand 91.**

SMITHS AIRCRAFT INSTRUMENTS, LTD., Cricklewood, London, N.W.2 (Gladstone 3333).—SEP2 Auto-pilot with new twin-compass system; artificial horizon (air driven), radio navigational indicators, de-icing system, precision motors and syncros, new 2in-diam. hermetically sealed indicators, and maximum safe air speed indicators. **S.B.A.C. Stand 2.**

SPERRY GYROSCOPE CO., LTD., Great West Road, Brentford, Middlesex (Ealing 6771).—Aircraft gyroscopic flight instruments, navigational equipment and automatic pilots; Gyrosyn compasses, gyro horizons, Zero Reader flight director, gyropilots, Duplex Flight Data system. **S.B.A.C. Stand 124.**

TINSLEY AND CO., LTD., H., Werndee Hall, South Norwood, London, S.E.25 (Addiscombe 1400).—Sensitive galvanometers and temperature indicators for use in aircraft and ground installations.

WAYMOUTH GAUGES AND INSTRUMENTS, LTD., Station Road, Godalming, Surrey (Enquiries to Gladstone 3333).—Electrostatic fuel-contents gauges, hermetically sealed fuel gauge system components, gas turbine temperature control amplifier equipment. **S.B.A.C. Stand 1.**

CABIN EQUIPMENT

BAYNES AIRCRAFT INTERIORS, LTD., Langley Aerodrome, Bucks (Slough 23861).—Design and construction of aircraft cabin furnishing, interior structures and equipment for airliners, freighters and troopers.

BENSON, J. J., 872/6 London Road, Leigh-on-Sea, Essex (Leigh-on-Sea 77423).—Aircraft interior furnishing. Dunlopillo handbuilders and stockists.

CONNOLLY BROS. (CURRIERS) LTD., 39/43 Chalton Street, London, N.W.1 (Euston 1661/5).—Leather for aircraft seating and panelling ("Vaumol" brand). Lightweight "Dulon" material for fuselage interior furnishing, etc. **S.B.A.C. Stand 105.**

COX AND SON, LTD., JOHN, Coxorian Works, Carlisle Road, London, N.W.9 (Colindale 4001).—Aircraft trimming manufacturers, suppliers of "Vynide" leathercloth to D.T.D. specifications 790, 407A, 540, and 3F.51, 3F.34, F.49, NF.101; carpets, fasteners, etc.

DRAGONAIR, LTD., Fitzherbert Street, Farlington, nr. Portsmouth, Hants (Cosham 76541). — Heating equipment for aircraft cabins; combustion heaters; air-conditioning equipment; hangar-heating equipment. **S.B.A.C. Stand 21.**

ELTRON (LONDON), LTD., Strathmore Road, Croydon (Thornton Heath 1861).—Electrically heated equipment for commercial aircraft: Hot cups, aircraft water heaters, hot meal containers. Oil tank immersion-heaters for easy winter starting.

FIRTH AND SONS, LTD., T. F., Africa House, Kingsway, London, W.C.2 (Holborn 4091).—Wool upholstery; lightweight materials in a range of colours and designs for aircraft furnishing; lightweight wool carpet in a variety of colours in plain and non-crush effects. **S.B.A.C. Stand 48.**

HAIRLOK CO., LTD., Iddesleigh House, Caxton Street, London, S.W.1 (Abbey 6722). — "Hairlok" rubberised hair. Moulded protective packaging for instruments, radio, electronic gear, missiles. Headrolls, seats, backs, arms, etc. "Texfoam" latex foam cushions, luxury seats, overlays and head pillows, etc. "Seatex" hair-reinforced latex foam —lightweight cushions, etc. **S.B.A.C. Stand 49.**

HOLDSWORTH AND CO., LTD., JOHN, Shaw Lodge Mills, Halifax (Halifax 3266). — Manufacturers of lightweight seating materials and special lightweight carpets for all types of aircraft.

IMPERIAL CHEMICAL INDUSTRIES, LTD., Leathercloth Division, Hyde, Cheshire (Hyde 651).—"Vynide" flame-resistant polyvinyl-chloride-coated fabric, in various weights and new and interesting designs for aircraft seating and panelling.

LATEX UPHOLSTERY, LTD., 41 Lonsdale Road, London, W.11 (Bayswater 6262-5). — Passenger luxury and high-density seating; latex foam and rubberised-hair fillings; cushions; padding; textile equipment; passenger safety-belts; freight containers. (as illustrated on page 389). **S.B.A.C. Stand 33.**

NORMALAIR, LTD., Yeovil, Somerset (Yeovil 1100).—Designers and manufacturers of valves and instruments for pressure-cabin air control; high-altitude oxygen-breathing equipment. Operates high-altitude chambers and laboratory for research and development in these problems. **S.B.A.C. Stand 62.**

RUMBOLD AND CO., LTD., L. A., Kingsgate Place, Kilburn, London, N.W.6 (Maida Vale 7366).—Designers and manufacturers of complete aircraft furnishings and sound-proofing. A.I.D. and A.R.B. design approval. Wide range of aircraft seats from high-density to luxury seating.

TINKERTEX, LTD., Holmfirth, nr. Huddersfield (Holmfirth 636/7).—Manufacturers of mothproof and fireproof upholstery fabrics for aircraft, car and domestic use.

VICKERS-ARMSTRONGS, LTD., Weybridge, Surrey (Byfleet 240).—Aircraft seating, fuel components and accessories. **S.B.A.C. Stand S.**

WARERITE, LTD., Ware, Herts (Ware 502) (unit of Bakelite, Ltd.). — Decorative laminated plastics. Panels, veneered board and Handy panels for linings, furniture surfaces, galley-units, pictorial panels for damage-resistant notices, diagrams, murals. **S.B.A.C. Stand 93.**

WEATHERSHIELDS, LTD., Bishop Street, Birmingham, 5 (Midland 5876). — "Coolride" cushions for pilots' and navigators' seating. Foam-rubber interiors for seating. Hoodings and canopies. Tube nuts, pressings and sub-assemblies.

WILKINSON RUBBER LINATEX, LTD., Frimley Road, Camberley, Surrey (Camberley 1595).—Linatex rubber seals for doors, windows, hatches, etc., including seals for aircraft with pressurized cabins. Flexatex non-rubber hose. Novatex plastic seals.

WILLIAMSON AND SON, LTD., JAS., Lune Mills, Lancaster (Lancaster 5222).—Fire-resistant, durable, lightweight, non-slip, hard-surfaced floor-covering, and fire-resistant vinyl-coated upholstery cloth.

WINN AND CO., LTD., CHARLES, Granville Street, Birmingham 1 (Midland 7151).—Water supply and special sanitary equipment for aircraft, to standard or customers' design.

G.E.C. two-compartment air-circulation oven for T.W.A.

MILITARY-AIRCRAFT SPECIAL EQUIPMENT

(Armament, Ejector Seats, etc.)

AIRMED, LTD., Harlow, Essex (Harlow 24331/2).—Aircraft breathing equipment, including masks and connecting tubing.

BRITISH, FOREIGN AND COLONIAL AUTOMATIC LIGHT CONTROLLING CO., LTD., 100 Holdenhurst Road, Bournemouth (Bournemouth 1445). — Timing mechanisms and mechanical fusing equipment.

BRITISH MANUFACTURE AND RESEARCH CO., LTD., Springfield Road, Grantham, Lincs (Grantham 700). — Hispano-Suiza guns, and shells, fuses and belt-feed mechanisms; power- and hand-operated gun mountings. **S.B.A.C. Stand 26.**

BURGESS AND CO., LTD., G. H., Havelock Road, Southall, Middx. (Southall 1816 and 2821).—A.I.D. approved. Aerial towed targets; precision engineering and sheet-metal work; supply-dropping equipment.

M. L. AVIATION CO., LTD., White Waltham Aerodrome, Maidenhead, Berks (Littlewick Green 248).—Radio-controlled pilotless target aircraft; high-speed target towing equipment; pressure cabin signal pistols; gunsight retraction mountings; mobile air-conditioning units; P.P.I. simulator training equipment; specialized electrical equipment. **S.B.A.C. Stand 40.**

MARTIN-BAKER AIRCRAFT CO., LTD., Higher Denham, Uxbridge, Middlesex (Denham 2214-8).—Designers of automatic ejection seats; ejection-seat training towers; mountings, blast tubes and belt feed mechanisms for gun installations; feathering controls and automatic oiling units for propellers. **S.B.A.C. Stand 204.**

SIEBE, GORMAN AND CO., LTD., Tolworth, Surbiton, Surrey (Elmbridge 5900).—Aircraft oxygen apparatus, aircraft safety belts, air compressors, self-contained breathing apparatus, protective clothing for fire-fighting. **S.B.A.C. Stand 99.**

PARACHUTES, DINGHIES AND SAFETY EQUIPMENT

EASCO ELECTRICAL, LTD., Brighton Terrace, London, S.W.9 (Brixton 4961).—A.R.B. approved for air-sea rescue equipment; life-jacket lights, raft and buoy lights, portable searchlights, hand lamps, battery-charging equipment.

ELLIOT EQUIPMENT, LTD., Llwynypia, Rhondda, Glamorgan, South Wales (Tonypandy 3232).—Dinghies, equipment-dropping parachutes, flying clothing, life-saving jackets, packs. A.I.D. and A.R.B.

FRANKENSTEIN AND SONS (MANCHESTER), LTD., P., Newton Heath, Manchester, 10 (Failsworth 1166).—Civilian and Services lifejackets; inflatable exposure-suits; flying overalls; constant-wear immersion suits; specialized rubber proofings to D.T.D. specifications. **S.B.A.C. Stand 18.**

G.Q. PARACHUTE CO., LTD., Woking, Surrey (Woking 2277).—Parachutes; supply-dropping containers; aircrew, stretcher and air/sea rescue safety harnesses; retractable brake and tail anti-spin parachutes. **S.B.A.C. Stand 61.**

IRVING AIR CHUTE OF GREAT BRITAIN, LTD., Letchworth, Herts (Letchworth 888). — M.o.S.-approved for design and development of all types of parachutes, including anti-spin and braking parachutes. **S.B.A.C. Stand 177.**

LEA BRIDGE INDUSTRIES, LTD., Arterial Road, Southend-on-Sea (Eastwood 55265-8).—Life-rafts, dinghies, balloons, lifting bags, inflatable equipment in rubber-proofed and plastic materials. Aircraft covers, protective clothing. A.I.D. and A.R.B. approval.

R.F.D. CO., LTD., Catteshall Lane, Godalming, Surrey (Godalming 1441). — Lifejackets; dinghies and rafts; survival equipment; gunnery training equipment; drogue, banner and winged targets; paratroop-training equipment; aircraft components and sub-assemblies. **S.B.A.C. Stand 58.**

SCHERMULY PISTOL ROCKET APPARATUS, LTD., THE, Newdigate, Surrey (Newdigate 331), and 51 Coleman Street, London, E.C.2.—Pyrotechnic stores for runway illumination, emergency landing, aircraft control, high-altitude signalling, air-sea rescue distress signalling, target identification, etc. **S.B.A.C. Stand 57.**

SUCAL INDUSTRIAL CLOTHING, Kangley Bridge Road, Lower Sydenham, London, S.E.26 (Sydenham 7016).—Aircraft safety equipment—protective clothing and armoured vests.

Y.S.C. LTD., THE, 45/47 Copeland Road, London, S.E.15 (New Cross 6113). — Pyrotechnic dept.; Y. S. C. standard "Very" cartridges and aeronautical pyrotechnics. Engineering dept.: Precision details for the aircraft industry (screws, bolts, and similar details).

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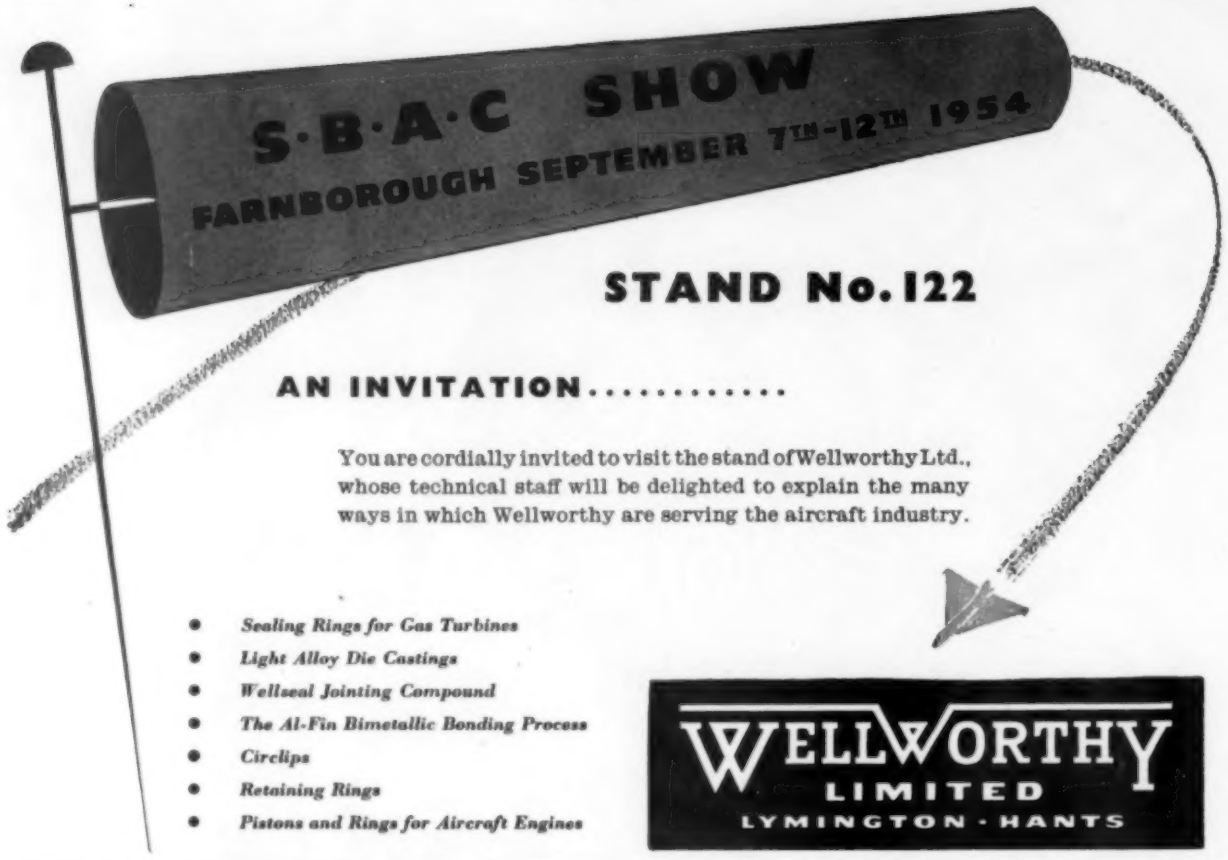

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THE AIRCRAFT INDUSTRY . . .

FIRE PROTECTION

AIRFOAM FIRE PROTECTION, LTD., 166 Victoria Street, London, S.W.1 (Victoria 3121).—Aerodrome Foam CO crash tenders, water bowsers, auxiliary domestic fire tenders and other aerodrome fire-protection ground equipment.

GENERAL FIRE APPLIANCE CO., LTD., 11 Waterloo Place, London, S.W.1 (Trafalgar 3765/7).—Chlorobromomethane (C.B.) equipment for airfields and crash fires; all fire protection equipment supplied.

GRAVINER MFG. CO., LTD., Poyle Mill Works, Colnbrook, Bucks (Colnbrook 48/49).—Manufacturers of airborne hand and full automatic fire-protection and ancillary equipment for prevention and extinction of fires in aircraft. **S.B.A.C. Stand 5.**

KIDDE CO., LTD., THE WALTER, Lux Works, Belvue Road, Northolt, Middlesex (Waxlow 1061).—Airfield fire-fighting tenders and equipment. **S.B.A.C. Stand 178.**

MERRYWEATHER AND SONS, LTD., Greenwich High Road, London, S.E.10 (Tideway 1016).—Fire engines, crash tenders, trailer pumps, fire extinguishers, smoke helmets, asbestos clothing, all varieties of fire-fighting equipment.

PYRENE COMPANY, LTD., THE, 9 Grosvenor Gardens, London, S.W.1 (Victoria 3401) and Great West Road, Brentford, Middlesex.—Fire equipment for aircraft, including both detection and extinguishing systems; airfield crash tenders, portable, mobile and fixed appliances for airfields. Also steel collapsible wheel-chocks; Parkerizing and Bonderizing metal-finishing processes. **S.B.A.C. Stand 70.**

THERMAL CONTROL CO., LTD., Marine Works, Sackville Road, Hove, Sussex (Hove 34081 and 35929).—Aircraft fire-detection equipment, pressure - operated switches, aircraft wiring and junction boxes. **S.B.A.C. Stand 261.**

FUELS AND LUBRICANTS

(Including Special-purpose Fluids and Refuelling Equipment)

ANGLO-IRANIAN OIL CO., LTD., Britannic House, Finsbury Circus, London E.C.2 (Central 7422).—Producers and distributors of B.P. aviation petroleum products. In the United Kingdom, B.P. Aviation Service is represented by Shell and B.P. Aviation Service of Shell-Mex and B.P. Ltd., the distributing company for the Anglo-Iranian and Shell Oil Groups. **S.B.A.C. Stand 191.**

AVERY-HARDOLL, LTD., Oakcroft Road, Tolworth, Surbiton, Surrey (Elmbridge 5221).—Designers and manufacturers of pressure refuelling equipment, self-sealing couplings for aviation fuels, oils, water-methanol high-test peroxide, etc. High-capacity bulk meters for all uses, including test rigs and calibration. **S.B.A.C. Stand 211.**

BENNETT (HYDE), LTD., Boston Mills, Hyde.—"Gunk" degreasant and cleaner for airframes, engines, components, hangar floors, workshops, and airfield aprons.

DUCKHAM AND CO. LTD., ALEXANDER, Hammersmith, London, W.6 (Fulham 3300).—Manufacturers of lubricating oils and greases, cutting fluids, preservatives and rust preventatives, skin cleansers and barrier creams.

EMCO BRASS MFG. CO., LTD., Westwood, Margate, Kent (Thanet 21521). — Aircraft fuelling nozzles, hydrant and refueller valves. Refuelling-tender emergency valves, faucets, swing joints, etc.

Esso "Pluto" 4,000-gall tanker at London Airport.

ESSO PETROLEUM CO. LTD., 36 Queen Anne's Gate, London, S.W.1 (Whitehall 5151).—Suppliers of fuels and lubricants and special products for the aviation industry. **S.B.A.C. Stand 71.**

FLIGHT REFUELLING, LTD., Tarrant Rushton Airfield, Blandford, Dorset (Blandford 501).—Air and ground pressure-refuelling equipment and components. Airframe component construction; repair, maintenance, modification, overhaul and conversion of aircraft. **S.B.A.C. Stand 161.**

GULF OIL (GREAT BRITAIN), LTD., Minoco Wharf, West Silvertown, London, E.16 (Albert Dock 3131).—Manufacturers of high-grade aero engine oils approved by Ministry of Supply and used by the Services and aircraft manufacturers.

JUNIPER, LTD., A. T., Liverpool, 18 (Sefton Park 1553).—Pressure re-oiling equipment for jet engines and gear boxes. Predetermined measuring guns and complete equipment for open-orifice filling of all liquids.

KILFROST, LTD., 20 Saville Row, Newcastle-upon-Tyne (Newcastle 20448); Works, Haltwhistle (332).—Manufacturers of de-icing fluids for removal of ice and hoar-frost; fluids used with T.K.S. system.

MANCHESTER OIL REFINERY (SALES), LTD., Twining Road, Trafford Park, Manchester 17 (Trafford Park 0218/9).—Manufacturers of lubricating oils, transformer oils and greases; also flaw detection inks for both magnetisable and non-magnetisable materials.

RAGOSINE OIL CO., LTD. (incorporating Rocol, Ltd.), Minerva Works, Woodlesford, near Leeds (Rothwell 2164).—Lubricant manufacturers. Specialists in molybdenum disulphide lubricants, instrument oils, and extreme-viscosity compounds for the optical instruments and electronics industries.

SHELL-MEX AND B.P., LTD., Shell-Mex House, Strand, London, W.C.2 (Temple Bar 1234).—Distributors of petroleum products for aviation; Shell Aviation Service; B.P. Aviation Service. **S.B.A.C. Stand 191.**

STEEL BARREL CO., LTD., Phoenix Works, Uxbridge, Middlesex (Uxbridge 8535-8).—Manufacturers of large-capacity pressure fuellers, aircraft servicers and transport tanks.

STREAM-LINE FILTERS, LTD., Ingate Place, London, S.W.8 (Macaulay 1011).—Filters for aviation refuelling purposes and for used lubricating oils.

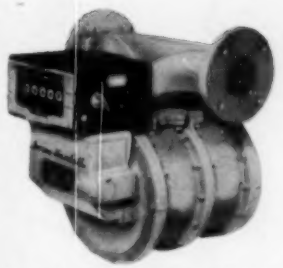
TECALEMIT, LTD., Plymouth and Brentford (Plymouth 2844 and Ealing 6661).—Manufacturers of lubrication equipment for aircraft and ancillary ground equipment; also engine and fuel-oil filters. **S.B.A.C. Stand 157.**

THOMPSON BROS. (BILSTON) LTD., Bradley Engineering Works, Bilston, Staffs (Bilston 41264/8).—Specialists in aircraft fuelling equipment and aircraft engine metalwork. **S.B.A.C. Show Stand 41 and Static Park.**

VACUUM OIL CO., LTD., Caxton House, London, S.W.1 (Whitehall 1010).—Mobiloil Aero engine oils, Mobil hydraulic oils, fluids, and specialities; Mobilgrease aero greases.

VAUGHAN AND CO., LTD., EDGAR, Legge Street, Birmingham, 4 and branches (Aston Cross 2071).—Oils and greases for the metal-working industry; hydraulic oils, rust preventatives, mechanical leathers.

WAKEFIELD AND CO., LTD., C. C., 46 Grosvenor Street, London, W. 1. (Mayfair 9232).—Castrol aero aviation and Castrol motor lubricants. Wakefield Lubrequipment; lubrication appliances of all types.



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ZWICKY, LTD., Slough, Bucks (Slough 24481).—Airfield refuelling units, lightweight rotor pumps, aircraft pressure-refuelling valves, pressure controllers, automatic tank filling nozzles, aircraft fuel filters, static pipeline systems, dispensing units, etc. **S.B.A.C. Stand 242.**

PAINTS AND FINISHES

(Including Protective Processes)

LEWIS BERGER (GREAT BRITAIN), LTD., Berger House, Berkeley Square, London, W.1 (Mayfair 9171).—Cellulose and synthetic (air drying and stoving) aircraft finishes to A.I.D. and C.C.I. requirements. Insulating varnishes, decorating paints, marine finishes.

BRITISH LEAD MILLS, LTD., Byron House, 7-9 St. James's Street, London, S.W.1 (Whitehall 5772).—Seculate anti-condensation compound for the interior of all aircraft and in particular for flight decks and cockpits.

CELLON, LTD., Kingston-on-Thames, Surrey (Kingston 1234).—Manufacturers of high-speed finishes and protective coatings for aircraft to A.I.D. and A.R.B. specifications; also Cellon pre-treatment primers, Celloseel kerosene- and Ester-lubricant-resistant jointing compound. **S.B.A.C. Stand 187.**

DOCKER BROTHERS, Ladywood, Birmingham 16 (Edgbaston 4111).—Specialists in aircraft finishes to all A.I.D. and A.R.B. requirements; protective and decorative finishes for airport buildings, transport and servicing equipment. Range includes etch primers, non-inflammable lacquers, paint removers and polishes for Perspex. **S.B.A.C. Stand 192.**

FERRO ENAMELS, LTD., Wombourn, Wolverhampton (Wombourn 2281).—Manufacturers of high-temperature ceramic coatings including "Solaramic." Designers and manufacturers of furnaces and kilns for H.T. ceramic coatings.

HALL AND SONS (BRISTOL AND LONDON), LTD., JOHN, Hengrove, Bristol (Whitchurch 2162), and St. Pancras Way, London (Euston 2262).—Cellulose and synthetic aircraft finishes, "Liquid Envelope" protective materials, factory paints. **S.B.A.C. Stand 95.**

IMPERIAL CHEMICAL INDUSTRIES, LTD. (Paints Division), Wrexham Road, Slough, Bucks (Slough 23851).—Full range of aircraft finishes to A.I.D. and defence specifications and A.R.B. requirements. Etching primer; fire-resisting clear and coloured dopes; Aero "Dulite" lightweight finishes; E.L.O.R. finishes; paint remover; metal pre-treatments. **S.B.A.C. Stand 125.**

JENOLITE, LTD., 43 Piazza Chambers, Covent Garden, London, W.C.2 (Temple Bar 1745, 3058, 5059).—Metal pre-treatment chemicals; rust and scale removers and inhibitors; paint keying agents; paint strippers; degreasants; black finishes; soldering solutions. **S.B.A.C. Stand 234.**

JENSON AND NICHOLSON, LTD., 36 St. James's Street, London, S.W.1 (Regent 6060).—Paints, enamels, varnishes, lacquers, dopes, etc. "Liquid Envelope" strippable protective coating.

LLEWELLYN RYLAND, LTD., Balsall Heath Works, Birmingham 12 (Calthorpe 2284-5-6).—Protective and decorative coatings to A.I.D. and A.R.B. requirements; cellulose, dopes and lacquers; oil primers and synthetic finishes; seaplane varnish; "Duralac" jointing compound; paint for hangars, factories, airport buildings. **S.B.A.C. Stand 139.**

MODERN INDUSTRIAL FINISHES, LTD., Lower Road, Northfleet, Gravesend, Kent (Gravesend 4922).—M.o.S.-approved "Sorco" finishes, resistant to Ester lubricants; high-temperature-resistant coatings for gas turbines.

PAINT REMOVERS, LTD., 24 Ryder Street, London, S.W.1 (Trafalgar 4161).—"Offkwik" paint remover.

TITANINE, LTD., Sheaveshill Avenue, Colindale, London, N.W.9 (Colindale 8123).—Aircraft finishes to current A.I.D. and A.R.B. requirements. Exterior and interior finishes for civil aircraft. Paints for ground equipment and aerodrome buildings. **S.B.A.C. Stand 154.**

VALAY INDUSTRIES, LTD., 186 Campden Hill Road, London, W.8 (Park 8601). — "Jove" specialized polish and wax for metal and painted surfaces of aircraft. "Wadpol," "Aeropol" and "Aerowax." **S.B.A.C. Stand 107.**

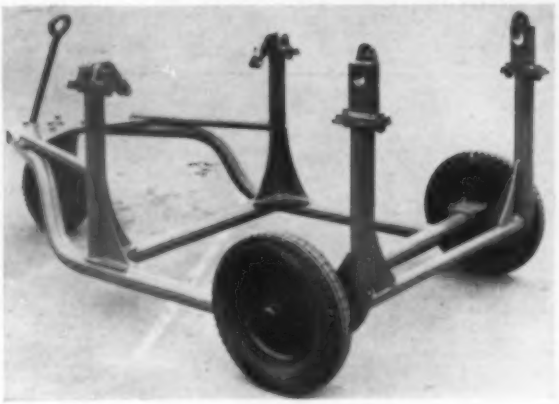
VULCAN PRODUCTS, LTD., 24 Ryder Street, St. James's, London, S.W.1 (Trafalgar 4161).—Manufacturers of Glossex transport finishes.

FACTORY AND AIRFIELD EQUIPMENT

ACCESS EQUIPMENT, LTD., Braemar Avenue, Neasden, London, N.W.10 (Gladstone 8283).—"Beanstalk," "Safety Raiser" and "Giraffe" hydraulic working platforms, and all types of access equipment. **S.B.A.C. Show Aircraft Park.**

ACRATORK ENGINEERING CO., LTD., Corys' Buildings, Bute Street, Cardiff (Cardiff 31141).—Precision torque spanners and torque generators. Test and setting rigs. R.A.E. approved. **S.B.A.C. Stand 225.**

ADCOLA PRODUCTS, LTD., Head Office and Sales: Gauden Rd., Clapham High Street, London, S.W.4.—Manufacturers of soldering instruments and allied equipment.



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THE AIRCRAFT INDUSTRY . . .

Factory and Airfield Equipment (continued)

AIRCRAFT ENGINEERING AND JIGS, LTD., Wren Works, Chadderton Lancs. (Oldham Main 5691).—Manufacturers of main and sub-assembly jigs, drill and assembly jigs, jig reference and lofting machines.

AIRSCREW CO., AND JICWOOD, LTD., Weybridge, Surrey (Weybridge 1600). — Electric fans and blowers; wind-tunnel fans; aircraft propellers; and windmills. **S.B.A.C. Stand 7.**

ANTICOUSTIC CO., 204 High Street, Guildford, Surrey (Guildford 66488).—Manufacturers of "Mallock-Armstrong" and "Nosonic" ear-defenders: "Nosonic" type TX can now be fitted with earpieces and microphones to special requirements.

AUTO DIESELS, LTD., Uxbridge, Middlesex (Uxbridge 5681).—Mobile aircraft starting and servicing units, including Crompton Parkinson Auto Diesel dual-voltage machines. **S.B.A.C. Stand 145 and Aircraft Park.**

AUTOMATIC COIL WINDER AND ELECTRICAL EQUIPMENT CO., LTD., Winder House, Douglas Street, London, S.W.1.—Manufacturers of A.I.D. and A.R.B. approved radio and electronic test gear and coil-winding machines.

AUTOSET (PRODUCTION), LTD., Stour Street, Birmingham (Edgbaston 1143).—Heavy-duty industrial castors; suspension slides for radar, etc., equipment; semi-precision ball journals; engineers' work- and tool-clamps; door runners, etc.

AVIATION DEVELOPMENTS, LTD., 229/231, High Holborn, London, W.C.2 (Chancery 8601). — Chobert automatic, and Avdel self-sealing, blind riveting systems, blind lock-nuts, Pip quick-release pins, Avdel sheet-grippers. **S.B.A.C. Stand 42.**

AVIATION TRADERS (ENGINEERING), LTD., 15 Great Cumberland Place, London, W.1 (Ambassador 2091) (works at Southend and Stansted Airports).—Manufacture of towing bars, jacks and special equipment. A.I.D. and A.R.B. approved. **S.B.A.C. Stand 102.**

B.S.A TOOLS, LTD., Kitts Green, Birmingham (Stetchford 3071).—High-production metalworking machine tools and small tools—multi-spindle bar and chucking machines, centreless grinders, drills, cutters, screwing tackle, etc.

BALLINGER, LTD., L. J. H., Woodchester, Stroud, Glos (Amberley 3231).—Abrasive-wheel cutting-off machines for bars, tubes, sections and slabs in the difficult alloys. Hydraulic test rigs and equipment.

BARDOLPH AND PARTNERS, LTD., J. F., 1 Robert Street, Adelphi, London, W.C.2 (Trafalgar 1927-9).—Concessionaires for Myers riveting clamps; Cat's Eye radar reflectors.

BARLOW-WHITNEY, LTD., 2 Dorset Square, London, N.W.1 (Ambassador 5485).—Process heating equipment.

BELLMAN HANGARS, LTD., Terminal House, Grosvenor Gardens, London, S.W.1 (Sloane 5259).—Erection, repair and maintenance engineers; manufacturers of hangars and large-span and unit-construction industrial buildings.

BIRLEC, LTD., Birlec Works, Tyburn Road, Birmingham, 24 (East 1471).—Gas and electric heat-treatment furnaces; electric arc and induction melting furnaces; adsorption drying equipment for maintaining low humidities in process air or gas flows (for wind tunnels, pressure-testing, etc.).

BLACK AND DECKER, LTD., Harmondsworth, Middlesex (West Drayton 2681).—Manufacturers of portable electric drills, sanders, grinders, polishers, screwdrivers, saws and valve and valve-seat reconditioning equipment.

BROOKE TOOL MANUFACTURING CO., LTD., Warwick Road, Birmingham, 11 (B'ham. Victoria 2323).—Standard-range and special engineers' small tools in high-speed steel, including milling cutters, end mills, form-relieved cutters, reamers, twist drills, drill chucks, pumps, jigs, fixtures, machined components. **S.B.A.C. Stand 100.**

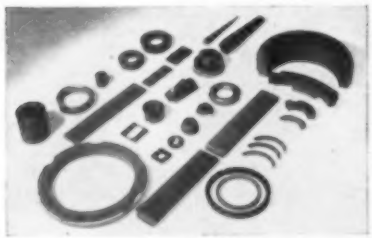
BROWN TRACTORS (ENGINEERING), LTD., DAVID, Meltham, Yorkshire (Meltham 361).—Tractors for airfield haulage.

BURGESS PRODUCTS CO., LTD., Hinckley, Leics. (Hinckley 700).—Electric hand-engraving tools, acoustic telephone booths and teleprinter covers, engine silencers and air-filters. (See also under "Electrical.") **S.B.A.C. Stand 258.**

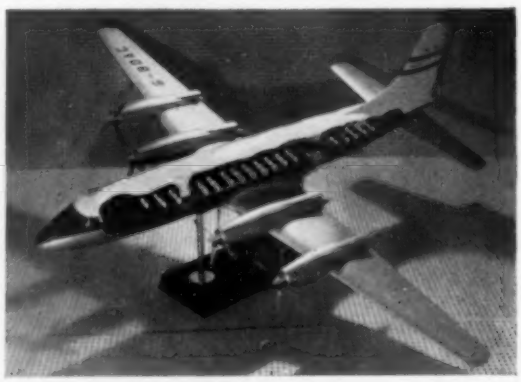
BURTON GRIFFITHS AND CO., LTD. (B.S.A. TOOLS GROUP.—Machine tools: Kitts Green, Birmingham (Stechford 3071). Small tools: Montgomery Street, Birmingham, 11 (Victoria 2351).—Distributors of British, American and European metalworking plant.

BUTLERS, LTD., Grange Road, Small Heath, Birmingham (Victoria 2164).—Designers and producers of lamps for aircraft and airfields. Searchlights for crash tenders, fighting vehicles, refuellers. Lamps for all other transport. A.I.D. approved.

CANNING AND CO., LTD., W., Great Hampton Street, Birmingham 18 (Central 8621).—Complete equipment, chemicals and ancillary supplies for electrodepositing all metals; polishing and burnishing machines and materials; lacquers and lacquering equipment.



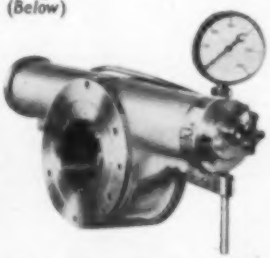
(Left) Seals, valves and other components in carbon by the Morgan Crucible Co., Ltd. (Right) New Chloride ultra-light 12-volt battery (4¾ lb for a capacity of 4 a.h.). (Below) Contrasting types of R.F.D. dinghies.



(Above) Part-sectioned model of a Britannia by Westway Models, Ltd.

(Left) Acratork hydraulic torque generator for pre-tensioning of screwed components.

(Below) A 2,400 Imp. gal. Leyland fueller of B.P. Aviation Services fuelling a B.E.A. Viscount at Zurich.

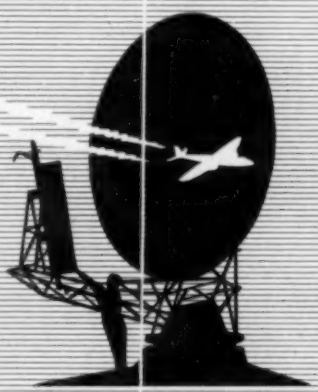


(Below) Lodge Plugs chemical cleaning unit, capable of cleaning 36 aircraft plugs at once.

COSSOR

SECONDARY AND SURVEILLANCE

RADAR



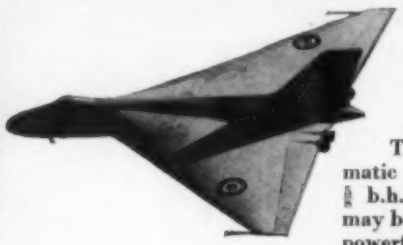
Pioneers in
Electronic Development
for over 50 years

A. C. COSSOR LIMITED · HIGHBURY GROVE . LONDON N.5.

S. B. A. C. DISPLAY · FARNBOROUGH 1954 · STAND NO. 63

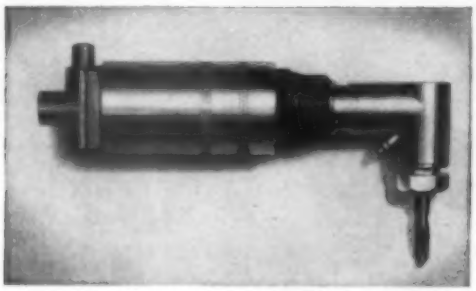
NEW Tools for New Aircraft

Since their introduction at the S.B.A.C. Display last year these four Desoutter Power Tools have been playing a vital role in speeding the production of Britain's super-priority aircraft. Each tool, originally designed to overcome a specific production problem, has now taken its place in our standard range.



S.R. 5 for the AVRO VULCAN

This powerful $\frac{3}{8}$" capacity Pneumatic Straight Drill develops nearly $\frac{5}{8}$ b.h.p. An adjustable side handle may be fitted when required. Its more powerful and slightly larger brother, the S.R.6. $\frac{1}{2}$" capacity drill, is also available.



R. 141 for the HAWKER HUNTER

The R.141 is a $\frac{5}{16}$" capacity Pneumatic Corner Drill. It has been designed to supplement our smaller Mighty Atom types, and is capable of drilling $\frac{5}{16}$" holes in steel to within $\frac{17}{32}$" of the inside face of a right angle.

M. 201 for the SUPERMARINE SWIFT

This Corner Nutrunner will run nuts in places previously thought inaccessible. After the nut has been run down the tool is used as a ratchet spanner. The nut cannot be overtightened as the required torque is controlled by regulation of the air pressure.

P. 56 for the VICKERS VALIANT

The P.56 Rivet Miller now replaces the M.56. It is a more powerful tool designed to deal with rivets up to $\frac{1}{2}$" in diameter. It has a new feature—a Micrometer adjustment which enables the depth of cut to be altered by increments of .00025".

See these tools on **STAND NO. 212**
S.B.A.C. Display, Farnborough

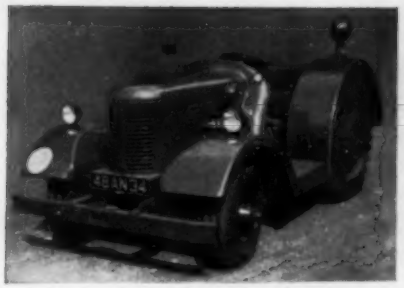
★ **STOP PRESS**

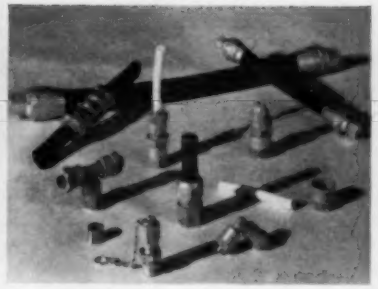
Desoutter announce a new portable pneumatic tool of great importance to aircraft manufacturers. First appearance on Stand 212 — don't miss it!

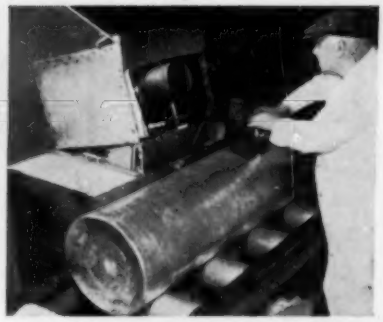
Desoutter POWER TOOLS

INCREASE AIRCRAFT PRODUCTION • Over 100 different Pneumatic and Electric Models.

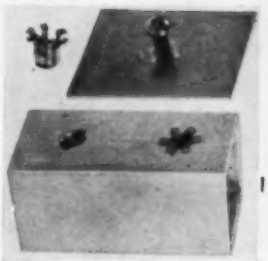
DESOUTTER BROS. LIMITED, THE HYDE, HENDON, N.W.9. TELEPHONE: COLINDALE 6346 (5 LINES). TELEGRAMS: DESPNUCO, HYDE, LONDON
CRCgM







(Left to right, above) David Brown VIG/IC tractor as ordered for the R.A.F.; examples of "Gyp" hose assemblies and fittings by High Pressure Components, Ltd; and Glass Developments, Ltd., Ultrasonoscope being used for testing light alloy billets by the Northern Aluminium Co., Ltd. (Right) Aviation Developments, Ltd., new "Avlok" blind anchor nut. (Extreme right) Components under test by Marconi Instruments, Ltd., industrial x-ray equipment.



THE AIRCRAFT INDUSTRY . . .

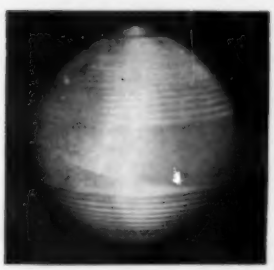
Factory and Airfield Equipment (continued)

CEMENTATION (MUFFELITE), LTD., 39 Victoria Street, London, S.W.1 (Abbey 5726).—Engine test house and wind tunnel silencing. European licensees for "Barry-mounts."

CHAMBERLAIN INDUSTRIES, LTD., Staffa Works, Leyton, E.10 (Leytonstone 3678). — Mobile and overhead travelling cranes; bending machines; steel and aluminium-alloy standard buildings. Patent steel flooring; structural steelwork; building and contracting.

CITY ELECTRICAL CO., Emerald Street, London, W.C.1 (Holborn 9722).—Designers and manufacturers of torque test rigs, altitude test rigs, starter test rigs, dynamometers, 400 cycle frequency-changers, and other special equipment and prototypes.

CLICO, LTD., Meadow Works, Meadow Street, Sheffield, 3 (Sheffield 26504).—Specialists in aircraft production tools, including router cutters.



New reinforced plastic pressure vessel by Dunlop.

COLLINGBRIDGE, LTD., B. F., Belvedere Works, Feltham, Middlesex (Feltham 2654).—Manufacturers of aircraft passenger steps (hydraulically operated), water bowsers, de-icer bowsers and luggage trailers.

COMMUNICATION SYSTEMS, LTD., Strowger House, 8, Arundel Street, London, W.C.2 (Temple Bar 4506).—Installation of private automatic telephones, intercommunication telephones, staff locator and sound amplification systems.

CREED AND CO., LTD., Telegraph House, Croydon, Surrey (Croydon 2121). — Telegraph engineers; manufacturers of teleprinter, high-speed morse and facsimile communication systems.

CULLUM AND CO., LTD., HORACE W., 8/9 Flowers Mews, London, N.19 (Archway 2662-5).—Silencing for hangar-type and dynamometer-type test houses; intake splitters for jet test-beds. Acoustic ceilings and wall lining; sound-proofing, including doors, windows, etc. Acousti-Celotex ceilings. Associated company: Detuners, Ltd.

CURRAN, LTD., JOHN, Curran Road, Cardiff (Cardiff 20641, Works, 44431).—Test equipment for turbo-jet, turboprop and piston engines. Turning gears for radar installations. General and aeronautical engineers. **S.B.A.C. Stand 34.**

DAWE INSTRUMENTS, LTD., 99 Uxbridge Road, Ealing, London, W.5 (Ealing 6215/7). — Electronic measuring instruments for the aircraft engineer; stroboscopes, vibration meters, sound-level meters, ultrasonic thickness gauges, laboratory test gear.

DESOUTTER BROTHERS, LTD., The Hyde, Edgware Road, London, N.W.9 (Colindale 6346).—Portable pneumatic and electric straight drills, corner drills, screwdrivers and nut-runners, shears, nibblers and grinders. **S.B.A.C. Stand 212.**

DETUNERS LIMITED, 8/9 Flowers Mews, London, N.19 (Archway 2662-5).—Cullum Detuners for jet test-bed silencing. Mk V and small Mk V for dry running; Mk VI for reheat. Associated company: Horace W. Cullum and Co., Ltd.

DEXION, LTD., Triumph House, 189 Regent Street, London, W.1 (Regent 4841).—Dexion slotted angle and accessories: maintenance platforms; racks, storage equipment, etc.

DOUGLAS EQUIPMENT, LTD., Kingsditch Lane, Tewkesbury Road, Cheltenham (Cheltenham 56361/2). —"Tugmaster" Aircraft tractors 5,000-25,000 lb tractive effort. Air crash and ground equipment tractors and carriers.

EDGHILL AND CO., LTD., H. W., Hook, Hants (Hook 40).—Aircraft ground equipment: passenger steps, maintenance platforms, engine stands, wing and tail trestles, drop-tanks and jet-pipe handling trolleys.

ELECTRICAL ENGINEERING CONSTRUCTION CO., LTD., Seymour Wharf, Totnes, Devon (Totnes 3282).—Aircraft starting and servicing units, all types, self-propelled and trailer.

ELGAR MACHINE TOOL CO., LTD., Hampton Road West, Hanworth, Feltham, Middlesex (Feltham 4266).—Manufacturers and importers of precision tool-room and production machines for the aircraft industry.

ENFIELD ROLLING MILLS, LTD., Brimsdown, Enfield, Middlesex (Howard 1255).—E.R.M. resistance welding electrode materials for the spot and seam welding of mild steel, stainless steel, nimonic alloys and aluminium and its alloys. Standard electrodes, holders, wheels and flash welding dies. Forgings, castings, rods, bars, sections and finished machined parts.

ENGLISH ELECTRIC CO., LTD., Kingsway, London, W.C.2 (Holborn 6966). — Test-plant equipment. **S.B.A.C. Stands Q and 128.**

ENGLISH NUMBERING MACHINES, LTD., Queensway, Enfield, Middlesex (Howard 2611).—Precision counting devices; plastic and alloy wheels and pinions for mechanisms of aircraft instruments, etc.

ESAVIAN, LTD., Esavian Works, Stevenage, Herts (Stevenage 500).—Manufacturers of large folding and sliding hangar doors in aluminium, and of folding and sliding doors of smaller sizes in wood.

FIELDING AND PLATT, LTD., Atlas Works, Gloucester (Gloucester 20351).—Designers and manufacturers of hydraulically operated presses, machines and ancillary equipment for the aeronautical, automobile, electrical and general engineering industries.

FIRTH BROWN TOOLS, LTD., Speedicut Works, Carlisle Street East, Sheffield, 4 (Sheffield 27151). — Manufacturers of engineers' cutting tools of all types: drills, reamers, cutters, screw-thread tools, carbide tools, saws, woodworking tools, etc.

FLEXIBLE DRIVES (GILMANS), LTD., 195 High Street, Smethwick, 41 (Smethwick 1202). — Flexible-drive machines and accessories for surface scaling, sanding, grinding, milling and filing; rotary milling cutters, files and rasps. **S.B.A.C. Stand 67.**

OTTERMILL SWITCHGEAR, LTD., 1, Victoria Street, London, S.W.1 (Abbey 5095).—Busbar trunking and associated switchgear for distributing electric power in repair hangars and machine shops.

GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2 (Temple Bar 8000).—Airport approach, runway and taxiway lighting; aircraft galley equipment; G.E.C. Heavy Alloy; Pren and P.G.C.A. lightweight aircraft cables. **S.B.A.C. Stand 136.**

GLASS DEVELOPMENTS, LTD., Sudbourne Road, Brixton Hill, London, S.W.2 (Brixton 4041).—Ultrasonoscope for flaw-detection in metals; equipment for accurate determination of elastic properties of materials; auto-correlation equipment for computers; instrument-dial luminising and reconditioning service, etc. A.I.D. and A.R.B. approved.

GLOSTER ENGINEERING (CHELTENHAM), LTD., 30 St. Paul's Street North, Cheltenham (Cheltenham 53961).—Router templates, rubber press dies, Hufford stretch tools etc., in Bakelite, laminated hardwoods and glass plastics. **S.B.A.C. Stand 73.**

GREEN AND SON, LTD., THOMAS, Smithfield Ironworks, Leeds (Leeds 20357).—Aerodrome mowers cutting up to 16ft wide. Power-driven rollers in weights from 15 cwt to 12½ tons.

H.M.L. ENGINEERING (AIRCRAFT DIVISION), 466-490 Edgware Road, London, W.2 (Paddington 0022).—Manufacturers of the H.M.L. universal hydraulic aircraft test rig and other hydraulic equipment.

HARTLEY BAIRD, LTD., 37/39 Thurloe Street, South Kensington, London, S.W.7 (Knightsbridge 2511). —Special-purpose electronic and recording equipment for commercial and military use.

Latex Upholstery, Ltd., "Kargo Pak" carries freight inconspicuously in a passenger cabin; it "sits" on two seats, the gusset seen in the close-up view bridging the armrest.

THE AIRCRAFT INDUSTRY . . .

Factory and Airfield Equipment (continued)

Model of a torque-reaction hangar stand (Heenan and Froude).

HEAD WRIGHTSON ALUMINIUM, LTD., Thornaby on Tees, Yorkshire (Stockton 65281).—Aluminium alloy structures, wind tunnels, hangars, hangar doors, sheds, overhead cranes, etc.

HEENAN AND FROUDE, LTD., Worcester (Worcester 3391/5).—Aircraft engine test-plant, including Froude hydraulic dynamometers, Heenan-Dynamatic dynamometers, Heenan jet-engine test plants, wind-tunnel test plants, hangar stands, torque-reaction stands, etc. **S.B.A.C. Stand 248.**

HINTON, LTD., D., School Lane, Exhall, Coventry (Bedworth 2171).—Specialists in manufacture of "Wimet" tungsten-carbide cutting tools and drawing dies.

HOLOPHANE, LTD., Elverton Street, London, S.W.1 (Victoria 8062).—Airfield and runway lighting equipment; hangar lighting units.

HOOVER, LTD., Perivale, Middlesex (Perivale 3311). — Electric cleaners, washing machines, polishers and "Glassmaster" glass-washing device for civil and service aircraft establishments and catering; fractional horsepower electric motors; commutators and switchgear.

HOUCHIN, LTD., Garford Street, London, E.14 (East 4123).—Makers of airfield ground-starter equipment and industrial mobile generating plant.

JENKS BROTHERS, LTD., Britool Works, Bushbury, Wolverhampton (Wolverhampton 31281). — Britool socket and ring wrenches in English, American, Metric and Unified sizes; midget to giant wrenches; specialized wrench equipment.

KENDELL AND SONS, LTD., T., French Place, Shoreditch, London, E.1 (Shoreditch 4782-4). — Machinery, knives and tools for cutting and punching paper, card, corrugated, rubber, fibre, plastics, leather, mica, etc.

KENTON EQUIPMENT, LTD., 708 Kenton Road, Kenton, Harrow, Middlesex (Wordsworth 7805). — B.O.A.C. hydrostatic weighing units for weighing, thrust measurement, structure testing, etc.

KING, LTD., GEO. W., Argyle Works, Stevenage, Herts (Stevenage 440). — Mechanical-handling equipment for the aircraft industry: Overhead cranes and runways, overhead and floor conveyors, electric and hand chain pulley blocks.

LACY-HULBERT AND CO., LTD., Boreas Works, Beddington, Croydon, Surrey (Croydon 5504/7).—Compressors, vacuum pumps, exhausters, desiccators, spray-painting equipment and pneumatic appliances.

LANSING BAGNALL, LTD., Kingsclere Road, Basingstoke (Basingstoke 1010).—Materials handling equipment; diesel, electric and petrol tractors; diesel and electric fork lift trucks; pallet and stillage trucks.—**S.B.A.C. Stand 199.**

LEYTONSTONE JIG AND TOOL CO., LTD., Leytool Works, High Road, Leyton, London, E.10 (Leytonstone 5022). — Designers and manufacturers of precision tooling equipment. Aircraft components and assemblies. High-quality hand and service tools.

LINCOLN ELECTRIC CO., LTD., Welwyn Garden City, Herts (Welwyn Garden 920). — Manufacturers of ground power units for starting and servicing turbojet and turboprop aircraft.

M.T.E. CONTROL GEAR, LTD., Leigh-on-Sea, Essex (Leigh-on-Sea 77224).—Mobile and static ground power units for aircraft servicing and starting of piston or gas-turbine aero engines.

MALLOCK - ARMSTRONG CO., 204 High Street, Guildford, Surrey (Guildford 66488).—Suppliers of ear defenders to the aircraft industry (see under Anticoustic Co., this section).

MARCONI INSTRUMENTS, LTD., St. Albans, Hertfordshire (St. Albans 6161-7). — Telecommunications measurement equipment, industrial X-ray and electronic instruments. **S.B.A.C. Stand 36.**

MASON, S., Denbigh House, Trentham Road, Longton, Stoke-on-Trent (Longton 33365).—Air drills, rivet hammers, squeezers, hand tools; 1,000 items in stock.

MAVITTA DRAFTING MACHINES, LTD., Highlands Road, Shirley, nr. Birmingham (Solihull 2231-2).—Full range of drafting machines, including new "Master" model; stands, rules and other drawing-office equipment.

MEERLOO AND SONS, LTD., JOHN, 74 London Road, Kingston-on-Thames (Kingston 2878).—A.I.D. approved. Steel marking punches and dies. All engraving. Stencil plates. Marking accessories.

MERCURY TRUCK AND TRACTOR CO., LTD., Northgate House, London Road, Gloucester (Gloucester 22025).—"Mercury" diesel and petrol engined trucks and tractors for towing aircraft, baggage trailers.

MODERN FURNACES AND STOVES, LTD., Booth Street, Handsworth, Birmingham 21 (Smethwick 1591). — Heat-treatment furnaces for light alloys, e.g., salt-bath and air-recirculating types. Reheating furnaces, batch and continuous types.

MORRIS, LTD., B. O. (Morrisflex), Briton Road, Coventry—Flexible-shaft machines, rotary files, cutters, rasps, polishing equipment, specialized machines for aero engines and airframe manufacturers, flexible shafting for remote controls. **S.B.A.C. Stand 162.**

MUREX WELDING PROCESSES, LTD., Waltham Cross, Herts (Waltham Cross 3636).—Engine-driven ground power units for servicing and starting all types of aircraft, including jet types. **S.B.A.C. Stand 262.**

NEW WELBECK, LTD., 120 New Bedford Road, Luton, Beds (Luton 3895).—Commercial and industrial vacuum cleaners, specially suitable for the industry, and as used by many leading aircraft constructors.

NORGREN, LTD., C. A., Shipston-on-Stour, Warwickshire (Shipston-on-Stour 110).—Compressed air-line equipment, including filters, pressure regulators, oil-fog and micro-fog lubricators, and air purifiers.

OPTICAL MEASURING TOOLS, LTD., 142 Bridge Road, Maidenhead, Berks (Maidenhead 3704).—Optical measuring instruments for the engineering industries. **S.B.A.C. Stand 78.**

PETBOW, LTD., Sandwich, Kent (Sandwich 3218). — Ground power servicing and starting units for all aircraft, outputs from 6 to 120 kW. Stand-by alternator sets for airfield lighting and radar.

PUREFOY UNIT TOOLING, LTD., J. B., Upper Tilt Works, Cobham, Surrey (Cobham, Surrey 3013). — Standard parts comprising a range of over 700 items to speed up the design and manufacture of jigs and fixtures. **S.B.A.C. Stand 86.**

RATCLIFFE TOOL CO., LTD., Gorst Road, London, N.W.10 (Elgar 6693), and Coed Coch Road, Old Colwyn, North Wales (Colwyn Bay 55288).—A.I.D. and A.R.B. approved. Jigs, fixtures, press tools and special-purpose machines.

REVO ELECTRIC CO., LTD., Tipton, Staffs (Tipton 1891).—Airfield lighting, comprising obstruction lights, floodlights, approach lights, taxi-way lights, sodium flares, road-way lights, control gear, etc. **S.B.A.C. Stand 254.**

ROBERT BUILDING INVENTIONS, LTD., Stover, nr. Newton Abbot, South Devon (Newton Abbot 1259).—Test rigs and aircraft maintenance docks in light alloy. Keylock construction. In association with Tiltman Langley Laboratories.

ROLLASON AEROCESSORIES, LTD., Croydon Airport, Surrey (Croydon 5151-4).—Designers and manufacturers of test equipment, including control, regulating and electric valves; universal controller for machmeter and instrument testing; de-frosting and hydraulic test trolleys. **S.B.A.C. Stand 134.**

ROSS, LTD., S. GRAHAME, 12A West Street, Chichester, Sussex (Chichester 2453). — Airfield and marine-base equipment.

ROZALEX, LTD., 10 Norfolk Street, Manchester, 2 (Blackfriars 1122).—Rozalex barrier creams, for protecting the skin against industrial irritants and occupational dermatitis. Technical advice available.

R.P.R. PATENTS, LTD., Alexandra Palace Station, London, N.10 (Tudor 2691).—Portable magnetic flaw-detectors (no power required) and demagnetizers; flaw-detection inks and quick-drying white sprays; magnetic flaw-detection testing.

S.M.D. ENGINEERS, LTD., Buckingham Avenue, Slough, Bucks (Slough 23212).—Aluminium industrial buildings, including hangars, nosedocks, etc., engineering structures in aluminium.

SAVAGE AND PARSONS, LTD., Watford By-Pass, Watford, Herts (Watford 6071).—Static and dynamic stress-analysis recording and plotting equipment (ground and airborne). Projection equipment, radar scanners and aerials. **S.B.A.C. Stand 6.**

SCIAKY ELECTRIC WELDING MACHINES, LTD., Farnham Road, Slough, Bucks (Slough 25551).—Manufacturers of aircraft resistance-welding plant, meeting high-speed jet and rocket structural requirements; stored-energy and moduwave welders for light alloys and heat-resisting steels of gauges from 24 s.w.g. to 0.250in. **S.B.A.C. Stand 111.**

SHORT AND MASON, LTD., Hale End Road, Walthamstow, London, E.17 (Larkswood 3371).—Meteorological instruments; wind speed and direction indicators.

SIMON EQUIPMENT, LTD., 48-50 George Street, London, W.1 (Welbeck 2371).—Designers and manufacturers of long-duration monitoring equipment (mechanical embossing, magnetic, etc.) for airport and general security purposes.

SKYHI, LTD., Worton Road, Isleworth, Middlesex (Hounslow 2211).—Main wing and wheel-change jacks: aircraft salvage equipment; "Skyflex" high-pressure hoses. **S.B.A.C. Stand 20.**

SMITHS OF STOCKPORT, LTD., Wellington Road South, Stockport (Stockport 4642).—Manufacturers of ground and airborne equipment: engineering, cable splicing, woodwork and machining.

STARAVIA, Blackbushe Airport, Camberley, Surrey (Camberley 1600).—Ground, overhaul, and test equipment; aircraft spares and ancillaries; specialists in Dakota aircraft; A.R.B. approved stockists.

SUNDSTRAND SANDERS, LTD., Shipston - on - Stour, Warwickshire (Shipston-on-Stour 110).—Pneumatic sanding machines with vibrationless, straightline motion for undertaking "rubbing down" of all types of surfaces, both flat and curved.

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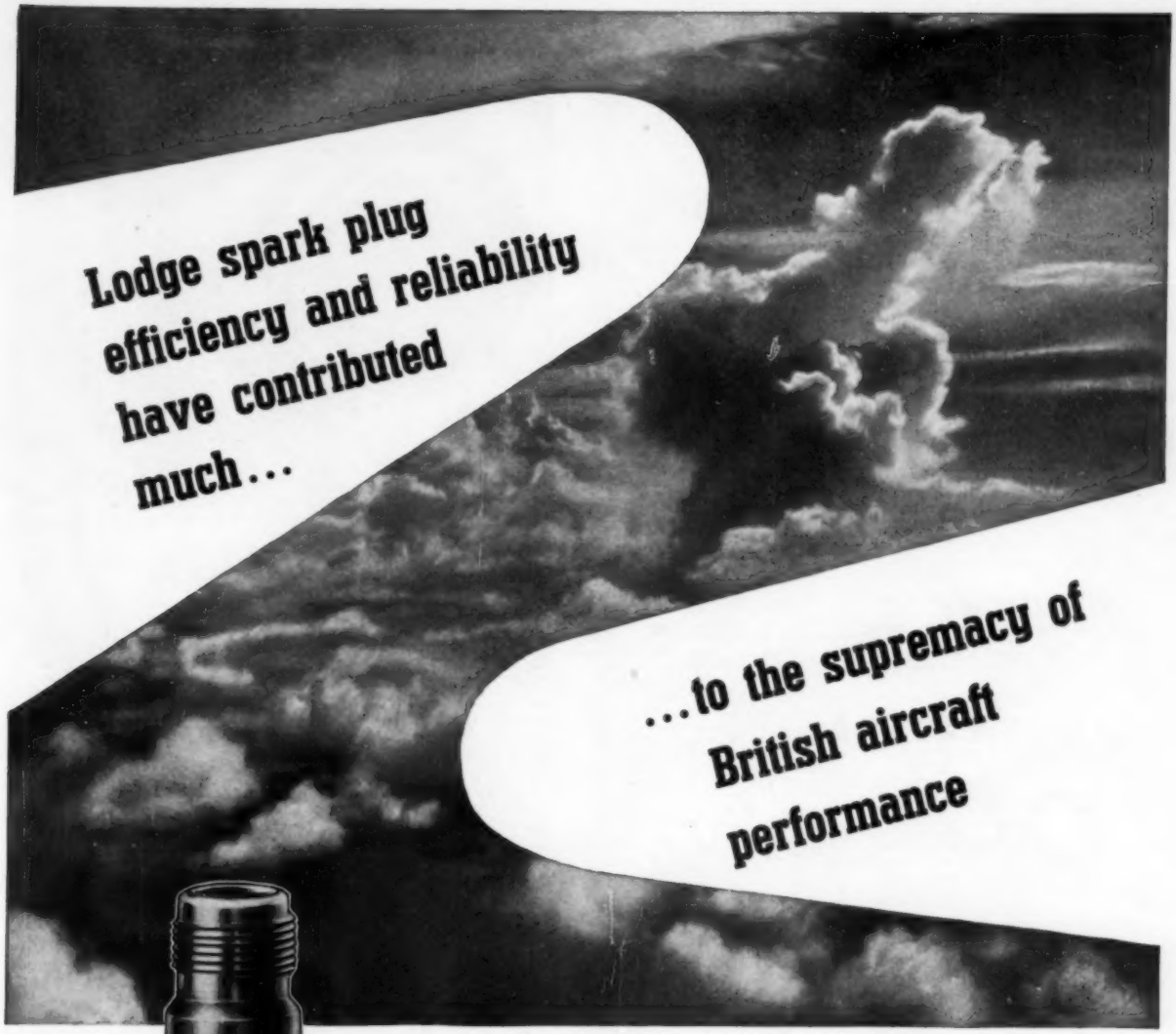

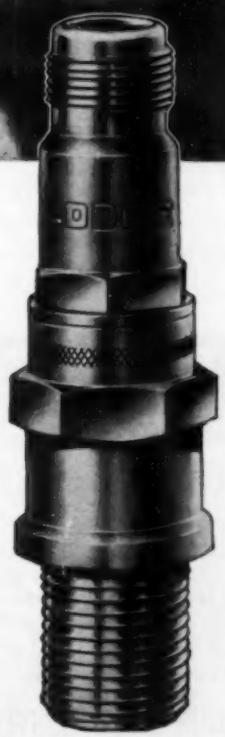

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THE AIRCRAFT INDUSTRY . . .
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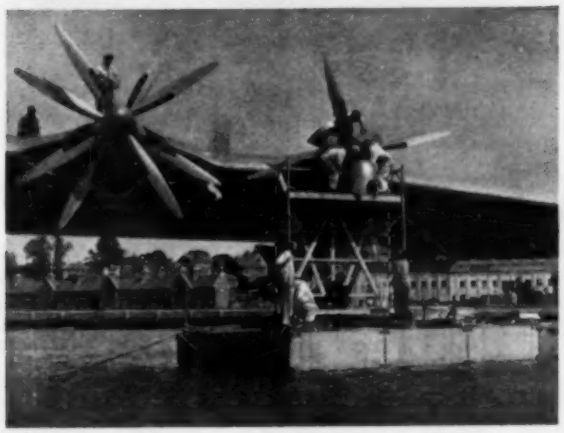

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SURREY CONCRETE, LTD., Peasmarsh, Guildford (Guildford 62986-7).—Manufacturers of pre-cast concrete buildings from 6ft to 40ft span, for garages, workshops, offices and canteens.

TANNOY PRODUCTS, LTD., 348 Norwood Road, London, S.E.27 (Gipsy Hill 1131).—Acoustic consultants and sound-reproducing-equipment manufacturers; complete installations on rental; new high power, light-weight "sky shouting" apparatus.

TAYLOR, TAYLOR AND HOBSON, LTD., Stoughton Street, Leicester (Leicester 20134).—Optical airframe tooling; turbine blade form projectors and edge microscopes; surface-finish and roundness-testing instruments.

TEST EQUIPMENT, LTD., Crompton Way, Crawley, Sussex (Crawley 1161/1162).—Designers and manufacturers of gyroscopic instruments and research equipment, wind-tunnel balances, manometers, high- and low-speed models, and all types of wind tunnel ancillary equipment.

THOMPSON (ENGINEERS) LTD., RAYMOND F., Harlow, Essex (Harlow 24341/2/3).—Designers and manufacturers of large and small press tools, large and small jigs and fixtures for parts and assemblies for aircraft. **S.B.A.C. Stand 133.**

TIPPING AND CO., LTD., C. R., "Tipco" Works, Leeds 12 (Leeds 30178/9).—Hand tools of aircraft finish. Socket sets; ratchets; ring, open-end and combination spanners; tension wrenches; special tools.

TREVOR - JOHNSTONE CO., LTD., 14 Berkeley Street, Piccadilly, London, W.1 (Grosvenor 3871).—Manufacturers of the R.V.A. continuous long-playing airport magnetic recorders. Producers of the "Ultrasonel" metallurgical flaw-detector equipment. Manufacturers of "Dialex" dictation-by-telephone system.

VAN MOPPES AND SONS (DIAMOND TOOLS), LTD., L. M., Basingstoke, Hampshire (Basingstoke 1240).—Diamond tools of all types, and especially those used in the aircraft industry. **S.B.A.C. Stand No. 197.**

VERNONS INDUSTRIES, LTD., Valley Road, Bidston, Birkenhead (Birkenhead 6416). — A.I.D. and A.R.B. approved manufacturers of airport ground equipment.

WEST AND PARTNERS, LTD., A., 36 Broadway, Westminster, London, S.W.1 (Abbey 3323).—Complete drawing-office equipment: instruments; materials; "Uno" pen stencils; photo-copies; sensitized materials.

WICKMAN, LTD., Coventry (Tile Hill 66271).—Manufacturers of multi-spindle and other precision and high-production machine tools and of Wimet cemented carbide tools and wear-resistant parts. Agents for English, American and Continental machines.

WOLF ELECTRIC TOOLS, LTD., Pioneer Works, Hangar Lane, London, W.5 (Perivale 5631-4).—Portable electric tools, and transport service equipment.

YOUNG AND CO., LTD., A. S., Tower Works, Woodside Lane, London, N.12 (Hillside 6606/7).—Welding plant, rods, fluxes, electrodes, and accessories. A.I.D. approved for application of Colmonoy hard-facing alloys.

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AEROCONTACTS, LTD., Gatwick Airport, Horley, Surrey (Horley 1510).—The SCOBA range of A.R.B. /A.I.D. approved products, covering every type of aircraft radio, electrical, general equipment, components, accessories, instruments, A.G.S. parts. **S.B.A.C. Stand 76.**

AEROFILMS, LTD., Chester Road, Boreham Wood, Herts (Elstree 2214).—Oblique and aerial photography, photomaps, models. Photographic library at 29 Old Bond Street, W.1 (Hyde Park 5211).

AERONAUTICAL RADIO SERVICES, LTD., Doman Road, Camberley, Surrey (Camberley 2341).—Aircraft radio and radar specialists. Overhaul, maintenance, development and design. A.I.D. and A.R.B. approved.

AEROSERVICES, LTD., Croydon Airport, Surrey (Croydon 9373).—Suppliers of aircraft, aero engines and spare parts. Aeronautical consultants.

AIR SERVICE TRAINING, LTD., Hamble, Southampton (Hamble 2181).—Training Division: Flying, navigation, engineering and radio training. (See also under "Aircraft Parts.") **S.B.A.C. Stand J.**

AIRSPEED PRECISION (LONDON), LTD., 22 Bruton Street, London, W.1 (Mayfair 9996/7).—Design and development; complete photographic service; precision engineering; steel and stainless steel tube manufacturers.

AIR SURVEY CO., LTD., 24, Bruton Street, London, W.1 (Mayfair 8791).—Air photography and topographic mapping from air photographs. (Subsidiary of the Fairey Aviation Co., Ltd.) **S.B.A.C. Stand K.**

AIRTECH, LTD., Aylesbury and Thame Airport, Haddenham, Bucks (Aylesbury 1163-4-5). — Manufacturers and repairers of complete aircraft; sub-assemblies; electrical components; radio and radio vehicles. Aircraft; engine and electronic-equipment sales.

AIR TRAINERS, LTD., Bicester Road, Aylesbury, Bucks (Aylesbury 922-3-4-5).—Manufacturers of synthetic instrument - flying trainers; electronic flight simulators. Sole licensees for manufacture of Link Trainers; spare parts and maintenance service. **S.B.A.C. Stand 235.**

AIRWORK GENERAL TRADING CO., LTD., 15 Chesterfield Street, London, W.1 (Grosvenor 4841).—Repair, maintenance and modification of aircraft to customers' specification; radio equipment and servicing; aircraft, engine and electronic-equipment sales. **S.B.A.C. Stand 11.**

ANTICOUSTIC CO., 204, High Street, Guildford, Surrey (Guildford 66488).—Sound-insulation materials and equipment. Low-pressure plastics mouldings and laminated components.

AUSTIN REED, LTD., 103-113, Regent Street, London, W.1 (Regent 6789) and principal cities.—Uniforms for officers of the Royal Air Force.

AVIATION AND ENGINEERING PROJECTS, LTD., Alexandra Road, Hounslow, Middlesex (Hounslow 9621).—Designers and consultants, A.R.B. and M.o.S. approved. Aircraft, sailplanes, components, etc. Technical publications. Jigs, tools, test rigs.

AVIATION TRADERS (ENGINEERING), LTD., 15 Great Cumberland Place, London, W.1 (Ambassador 2091) (works at Southend and Stansted Airports).—Aircraft overhaul and conversion; overhaul, repair and supply of radio and electrical equipment and aircraft instruments. A.I.D. and A.R.B. approved. **S.B.A.C. Stand 102.**

AVIATION TRADERS, LTD., 15 Great Cumberland Place, London, W.1 (Ambassador 2091).—Sale of aircraft components and accessories; consultants and insurance. (See also Aviation Traders [Engineering], Ltd.)—**S.B.A.C. Stand 102.**

AVIGATION, LTD., 30, Central Chambers, London, W.5 (Ealing 8949).—Postal and direct tuition for all pilot/navigator licences. Eight-colour illustrated lecture notes. Link training division and general printing department. Flying arranged.

BEAUMONT, 59, Russell Road, Forty Hill, Enfield, Middx (Enfield 6886).—Aviation books, magazines and all classes of aeronautical literature.

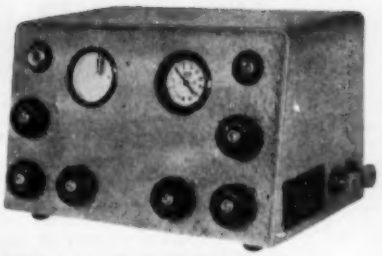
B.K.S. ENGINEERING, LTD., Southend Airport, Essex (Rochford 56496-7).—Complete aircraft overhauls, radio overhauls, component part manufacture, luxurious interior conversions (36- and 40-seat Dakotas). A.R.B. and A.I.D. approved.

BRAND AND CO., LTD., R. A. Spray Packaging Division, 72/75 Red Lion Street, London, W.C.1 (Chancery 2605).—Sprayed "Cocoon" and "Texikoon" covers. **S.B.A.C. Stand 14.**

BRITISH AVIATION INSURANCE CO., LTD., 3-4 Lime Street, London, E.C.3 (Mansion House 0444). — Aviation insurance. Air Safety and Survey Division: Basildon House, Moorgate, London, E.C.2 (Monarch 4764).

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY, Shakespeare House, 17-19 Stratford Place, London, W.1 (Mayfair 0812). Postal tuition for all branches of aeronautical engineering and professional aeronautical examinations.

BRITISH OXYGEN CO., LTD., Cleveland Row, St. James's, London, S.W.1 (Whitehall 9777).—Liquid oxygen rocket-fuel oxidant; Argonarc welding; carbon dioxide inflation; pressure die-castings (Sparklets, Ltd.); oxygen for high flying; Melamine. **S.B.A.C. Stand 224.**



Rollason Aerocessories, Ltd., universal controller for machmeter and other instrument testing.

BRITISH TRANSFER PRINTING CO., LTD., Harefield Road, Coventry (Coventry 64021).—Transfers for marking aircraft, charter and company badges, R.A.F. and Commonwealth crests, Union Jacks, Royal Airmail crests.

BROOKLANDS AVIATION, LTD., Weybridge, Surrey (Weybridge 3821) and Sywell, Northampton.—Manufacturers and designers of winged targets. Aircraft constructors and repairers to Ministry of Supply. A.I.D. and A.R.B. approved for all classes of overhauls. **S.B.A.C. Stand 230.**

C. AND S. AIRCRAFT (Components and Spares (Aircraft), Ltd.), Blackbushe Airport, Camberley, Surrey (Camberley 1600, Extns. 307-8).—A.R.B. approved. Aircraft and engine sales, overhauls, magneto and carburettor spares, radio, instruments. Magnaflux crack detection.

CARTWRIGHT HAMILTON AVIATION, 282 Kensington High Street, London, W.14 (Western 0207).—Aviation consultants: services covering the brokerage of aircraft and spares of all types to the requirements of commercial operators and private owners.

CHEMRING, LTD., 62/4, Temple Chambers, Temple Avenue, London, E.C.4 (Central 8361). — Meteorologic... adar reflectors, for wind finding.

COLLEGE OF AERONAUTICAL AND AUTOMOBILE ENGINEERING, Sydney Street, Chelsea, London, S.W.3 (Flaxman 0021).—Comprehensive full-time technical and practical training for careers in all branches of aviation engineering.

DUNDAS, LTD., R. K., 29, Bury Street, London, S.W.1 (Whitehall 2848) and at Bombay, Karachi and Johannesburg. — Aviation agents, brokers, consultants; home and overseas sales of aircraft, engines, spares, accessories, airport equipment.

EAGLE AIRCRAFT SERVICES, LTD., Blackbushe Airport, Camberley, Surrey (Yateley 2371).—A.R.B. and A.I.D. approved. Aircraft conversions, overhaul, maintenance; hydraulic, instrument and radio servicing facilities; Viking and Dakota parts stockists; aircraft consultants.

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FELTHAM AND SON, LTD., WALTER H., Imperial Works, Tower Bridge Road, London, S.E.1 (Hop. 1784/5).—Post-sample and cotton bags for packing spare parts, small fittings, etc.

FIELD AIRCRAFT SERVICES, LTD., Croydon Airport, Croydon, Surrey (Croydon 7777).—Comprehensive aircraft service: overhaul, repair, modification; engines, airscrews, instruments, accessories, spares; repair and salvage. Manufacturing division: Components and assemblies. Sales and projects division: Medium and heavy aircraft, engines, etc. Ferry flying of all types. **S.B.A.C. Stand 163.**

**Companies that are primarily airline and/or charter operators are not included: these are dealt with in our annual "Commercial Aviation" special number.*

THE AIRCRAFT INDUSTRY . . .

Miscellaneous (continued)

FISHERS, 86/88 Wellington Street, Woolwich, London, S.E.18 (Woolwich 1055).—Naval, military and R.A.F. tailors and outfitters. Officer's uniforms for home and overseas.

FLINT, LTD., HOWARD, Avery House, Avery Row, London, W.1 (Mayfair 3282).—Manufacturers of all types of flying clothing. **S.B.A.C. Stand 80.**

F.O.C. CARAVAN CENTRE, 200-220, Cricklewood Broadway, London, N.W.2 (Gladstone 2234).—Main distributors for leading holiday and residential caravans. Mobile offices and special-purpose trailers.

FOX AND SONS (AVIATION), LTD., C. J., 117 Victoria Street, London, S.W.1 (Victoria 0204).—Aircraft brokers; specialists in supply of Dakotas. Sole agents for the Met-I-chek crack detection process (meeting requirements of civil inspection procedure B1/8-2).

GIEVES, LTD., 27 Old Bond Street, London, W.1 (Hyde Park 2276).—Uniform and flying clothes specialists. Uniforms and badges for airlines and clubs. Designs submitted.

GUIDE BRIDGE RUBBER CO., LTD., Vulcan Mill, Butcher Lane, Bury, Lancs (Bury 2216).—Manufacturers of meteorological, pilot, sounding and high-altitude balloons.

HELICOPTER SALES (C.C.), LTD., Old Mill Road, Hunton Bridge, Herts (Kings Langley 2511).—U.K. dealers for Hiller Helicopters and for SNCASO Djinn; dealers in second-hand helicopters.

HENLY'S, LTD., 385 Euston Road, London, N.W.1 (Euston 4444).—Aviation department dealing exclusively with vehicle requirements of the aeronautical industry; mechanical-handling equipment.

HUDES MERCHANDISING CORPORATION, LTD., 52 Gloucester Place, London, W.1 (Welbeck 3521).—Swissair navigator (pocket computor); Nestler slide-rules and drawing equipment; Sartorius analytical balances; all metallurgical and laboratory equipment.

HUNTING AEROSURVEYS, LTD., 6 Elstree Way, Boreham Wood, Herts (Elstree 2214).—Aerial survey; preparation of maps, plans, photographic mosaics, models and dioramas. Natural-resources inventories. Airborne magnetometer and scintillometer surveys.

ILFORD, LTD., 106-107 High Holborn, London, W.C.1 (Holborn 3401-6).—Manufacturers of photographic plates, paper and film.

IMHOF, LTD., ALFRED, 112-16 New Oxford Street, London, W.C.1 (Museum 7878).—Manufacturers of sheet metal instrument cases, racks and accessories.

INTERNATIONAL AERADIO, LTD., 40 Park Street, London, W.1 (Hyde Park 5024).—Specialists in aeronautical radio, air traffic control and airport operation. Producers of the *Aerad Flight Guide*, maps and charts.

JAMESON AERO ENGINES, West Street Works, Ewell, Surrey (Ewell 4748).—General engine and aircraft research and development work.

KEARSLEY AIRWAYS, LTD., Stansted Airport, Stansted, Essex (Stansted 3307).—Electric, ignition, hydraulic, fuel, de-icing and vacuum component overhauls. Dynamic balancing. Spares stockists.

LAMBERT BROTHERS, LTD., Cunard House, 88 Leadenhall Street, London, E.C.3 (Avenue 2000).—Air charter; airline passenger and freight bookings (I.A.T.A. agents); sale and purchase of aircraft and spares; insurance.

LANCASHIRE AIRCRAFT CORPORATION, LTD., 7 Berkeley Street, London, W.1 (Grosvenor 7721). Bases at Squire's Gate and Bovingdon).—Air-transport specialists; all aeronautical services; contractors to H.M. Government; repair and maintenance; aircrew training; aerodrome management and catering.

LEP AIR SERVICES, LTD., Sunlight Wharf, Upper Thames Street, London, E.C.4 (Central 5050).—Air-freight shipments to all parts of the world; air-charter brokers.

LEP TRANSPORT, LTD., Sunlight Wharf, Upper Thames Street, London, E.C.4 (Central 5050).—Aircraft packers and shippers, packing consultants. Specially designed cases for aircraft components. Tropical packing. Approved by A.I.D., I.E.M.S., C.I.S., and Admiralty. **S.B.A.C. Stand 229.**

LEWIS, LTD., D., 124 Great Portland Street, London, W.1 (Museum 4314).—Flying clothing, including suits, helmets, oxygen masks, intercom. equipment, goggles, boots, etc.

MARSHALLS FLYING SCHOOL, LTD., Airport Works, Cambridge (Cambridge 56291).—Aircraft overhauls, conversions, trial installations and modifications; component design, development and manufacture. Radio overhaul and maintenance. A.I.D. and A.R.B. approved.

MERIDIAN AIRMAPS, LTD., Shoreham Airport, Sussex (Shoreham-by-Sea 2366).—Aerial survey and photography; high-precision maps and plans.

MUIR AND ADIE, LTD., Croydon Airport, Surrey (Croydon 7744).—Aeronautical engineers. Aircraft sales and service. Aircraft accessories.

NEWTON AND CO., H. T., Gatwick Airport, Surrey (Horley 3613 and 1510).—A.R.B. and A.I.D. approved stockists of aircraft spares. British Commonwealth agents for Ambrosini Rondone; European agents for the Aerocar.

NORTHAMPTON POLYTECHNIC, St. John Street, London, E.C.1 (Clerkenwell 1662-3). — Technical college (over 5,000 students) specializing in engineering subjects and including full-time day, part-time day and evening classes. Courses lead to the B.Sc.(Eng.) degree of London University and to Higher National Certificates, which include in both cases specialization in aeronautical engineering.

PARK, LTD., R. AND J., Dominion Works, Thames Road, Chiswick, London, W.4 (Chiswick 7761).—Aircraft packing and shipping; preservation and tropicalization; casemakers and woodworkers; insurance. **S.B.A.C. Stand 121.**

PITMAN AND SONS, LTD., SIR ISAAC, 39-41 Parker Street, Kingsway, London, W.C.2 (Holborn 9791).—Publishers of books on all technical subjects, including aviation and aeronautics, electrical engineering, radio, etc.

PORTSMOUTH AVIATION, LTD., The Airport, Portsmouth, Hants (Portsmouth 70374). — Approved aircraft design and production organization; armament, airborne and ground equipment development specialists; approved production facilities; sub-contract design and development.

PROOPS BROS., LTD., 119 Charlotte Street, London, W.1 (Langham 0141/2).—Stockists of ground and test equipment; British and American airframes and engines; piston and turbine spares; radio and electrical spares.

RACAL AEROTRONICS, LTD., Building 46, Blackbushe Airport, Camberley, Surrey (Yateley 3334).—Installation and servicing of all types of aircraft radio. A.R.B. and A.I.D. approved.

RACAL, LTD., Bracknell, Berks.—Aviation communications consultants; design and supply of communication systems and electronic equipment.

L. K. REGENT, LTD. (Air Division), Maddox House, 215-221 Regent Street, London, W.1.—Aeronautical engineers and contractors; suppliers of aircraft equipment; aeronautical consultants.

REYNOLDS (PACKAGING), LTD., Alfreds Way, Barking, Essex (Rippleway 3586/9).—A.I.D. approved packing to M.o.S. specs.: wax-dip, polythene, metal-foil laminate and plastic-spray coating. Export packers to the industry. **S.B.A.C. Stand 108.**

High-speed R.A.F. launch, designed and built by Vosper, Ltd.

RIST'S WIRES AND CABLES, LTD., Lower Milehouse Lane, Newcastle, Staffs (Newcastle 69212/3/4).—Electric cable manufacturers for industrial, housewiring and automobile purposes; large and small assembly wiring a speciality.

ROBERTS AND WOOTTON, LTD., The Old Mill, The Common, Cranleigh, Surrey (Cranleigh 732).—A.R.B.-approved designers. Consultants on structural, mechanical and marine problems.

ROLLASON ENGINES, LTD., Croydon Airport, Surrey (Croydon 5151-4).—Aero engine sales and service. Operators of exchange and overhaul schemes for D.H. Gipsy Major, Six, Queen II and III. Stockists of aero engine spares and P. and W. engines.

ROLLASON, LTD., W. A., Croydon Airport, Surrey (Croydon 5151-4).—A.R.B. and A.I.D. approved for C. of A. overhaul repair and modification of aircraft. Stockists of spares for airframes and engines. Sales of all aircraft and engine types. Tiger Moth specialists.

SCHOOL OF GAS TURBINE TECHNOLOGY, Farnborough Place, Farnborough, Hants (Farnborough 1300-2).—Intensive courses in the design, construction and maintenance of gas turbines.

SCOTTISH AVIATION, LTD., Prestwick Airport, Ayrshire (Prestwick 79888).—Aircraft designers and manufacturers of Pioneer aircraft (see in aircraft-review section of this issue). A.I.D. and A.R.B. approved for conversion and C. of A. and other overhauls. **S.B.A.C. Stand H.**

SHACKLETON, LTD., W. S., 175 Piccadilly, London, W.1 (Hyde Park 2448/2449). — Aeronautical consulting engineers: suppliers of new and used aircraft, engines, materials and spares for home and export.

SHAWCRAFT MODELS, Bathurst Walk, Iver, Bucks (Iver 84).—A.R.B. approved. Scale models of aircraft, aero engines and equipment. Pattern makers; wooden components.

SKYWAYS, LTD., 7 Berkeley Street, London, W.1 (Grosvenor 7721). (Bases at Stansted, Bovingdon, Hamburg, Malta, Cyprus and Beirut).—Air-transport specialists; all aeronautical services; contractors to H.M. Government; repair and maintenance; aircrew training; aerodrome management and catering.

SOUTHERN DRAWING SERVICES, LTD., 693A Christchurch Road, Boscombe, Hants. (Boscombe 34094).—Drawing office consultants and suppliers of drawing office equipment. Specialists in full-scale photolitho layout.

SUCHY HOLDINGS, LTD.—See subsidiary companies: Chemring, Ltd. (in this section); Dowsing Co. (Electrical Manufacturers), Ltd. (under "Aircraft Parts"); British, Foreign and Colonial Automatic Light Controlling Co., Ltd. (under "Military Aircraft Special Equipment"); Sucal Industrial Clothing (under "Parachutes, Dinghies and Safety Equipment").

SUTTON (CONSULTANTS), LTD., R. W., 7 Lansdowne Place, Cheltenham (Cheltenham 5811).—Specialists in sales development and business negotiations between U.K. and Canada.

TILTMAN LANGLEY LABORATORIES, LTD., Redhill Aerodrome, Surrey (Nutfield Ridge 2232/34).—Design, development and research engineers. A.I.D. and A.R.B. approved. Contractors to Admiralty, Ministry of Supply and the aircraft industry. **S.B.A.C. Stand 167.**

UNIVERSAL FLYING SERVICES, LTD., Fair Oaks Aerodrome, Chobham, Surrey (Chobham 375).—Proprietors of Fair Oaks Aero Club. A.I.D. and A.R.B. approved for C. of A. overhauls; maintenance, hangarage, flying tuition.

VINTEN, LTD., W., 715 North Circular Road, Cricklewood, London, N.W.2 (Gladstone 6373/5).—Aircraft cameras; reconnaissance, instrumentation, take-off and ciné cameras. **S.B.A.C. Stand 253.**

VOSPER, LTD., Portsmouth.—Air/sea rescue craft, crash tenders, firefloats, seaplane tenders, refuellers, target-towing craft, airborne lifeboats, etc.

WALTER, A. J., Gatwick Airport, Horley, Surrey (Horley 1420 and 1510, Ext. 105-6).—Supply of aircraft and engine spares, accessories, etc., for British and American aircraft.

WARDEN AVIATION CO., Old Warden Aerodrome, Biggleswade Bedfordshire (Northill 288).—A.R.B. approved for C. of A. overhauls, repairs, modifications; spares; hangarage; sales.

WARDEN AVIATION AND ENGINEERING CO., Old Warden Aerodrome, Biggleswade, Beds (Northill 288).—Overhaul, repair, and maintenance of light civil aircraft. Hangar accommodation, fuel, and spares. Reconstruction and operation of veteran aircraft.

WEST AND PARTNERS, LTD., A., 36 Broadway, Westminster, London, S.W.1 (Abbey 3323).—Photo-copying and photo-printing specialists.

WESTWAY MODELS, LTD., 15-17 Brunel Road, East Acton, London, W.3 (Shepherds Bush 6868, 2332, 7022).—Scale models for exhibition, display, sales promotion, etc.; in metal, wood, or plastics, solid and "cut-away." Also technical, scientific and instructional models.

WILLIAMSON MANUFACTURING CO., LTD., Litchfield Gardens, London, N.W.10 (Willesden 0073/5). — Constructors of air cameras for survey, reconnaissance and gunnery recording; mapping instruments. **S.B.A.C. Stand 140.**

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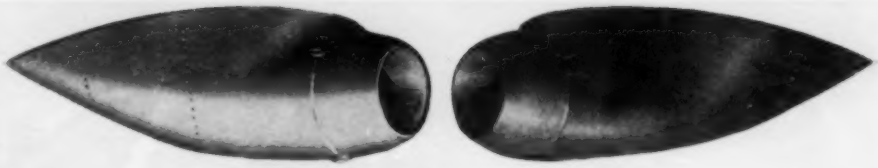

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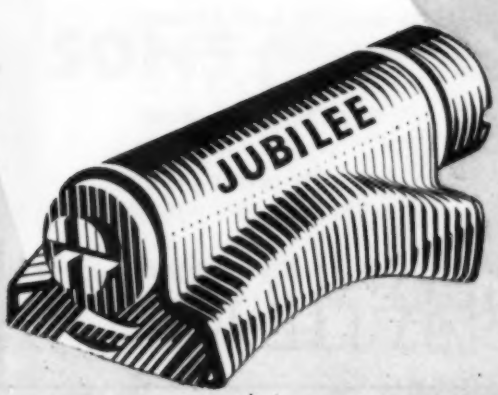

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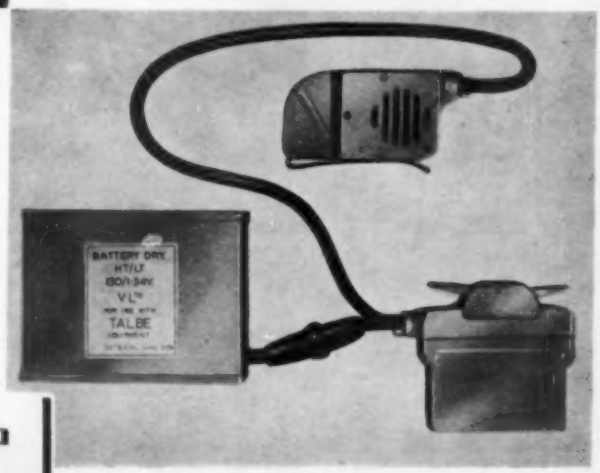

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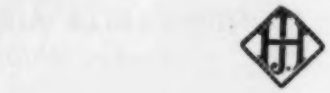

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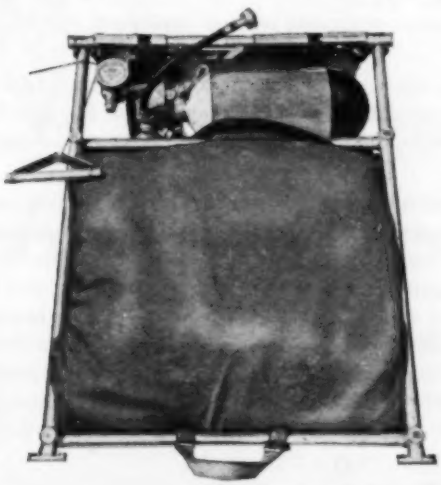

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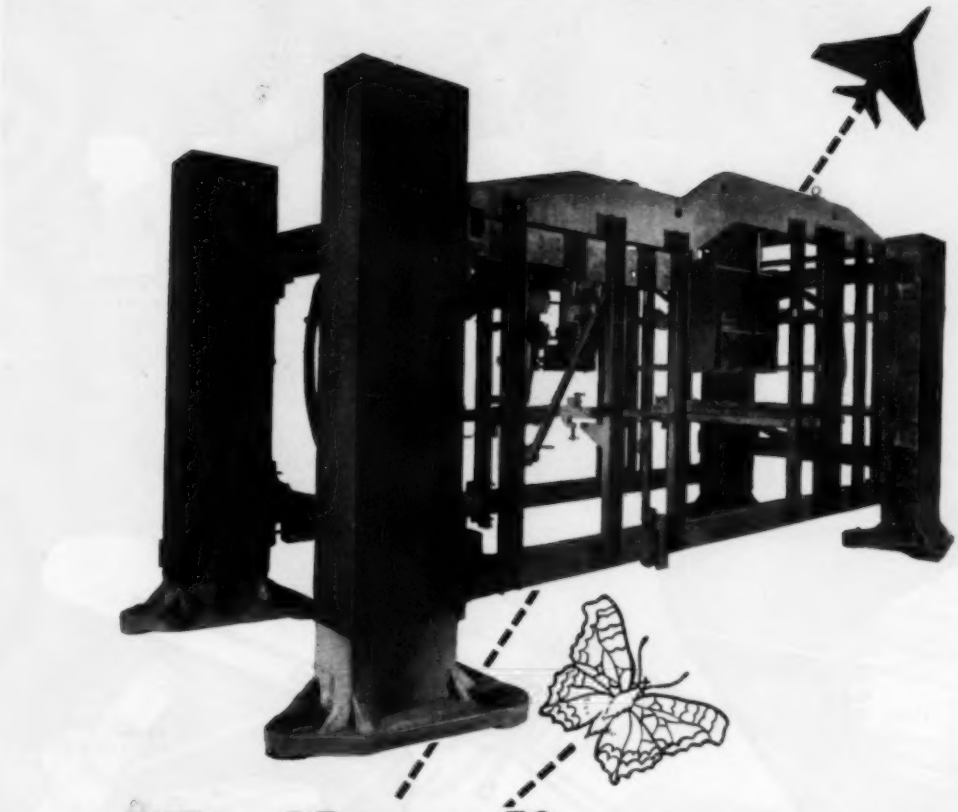

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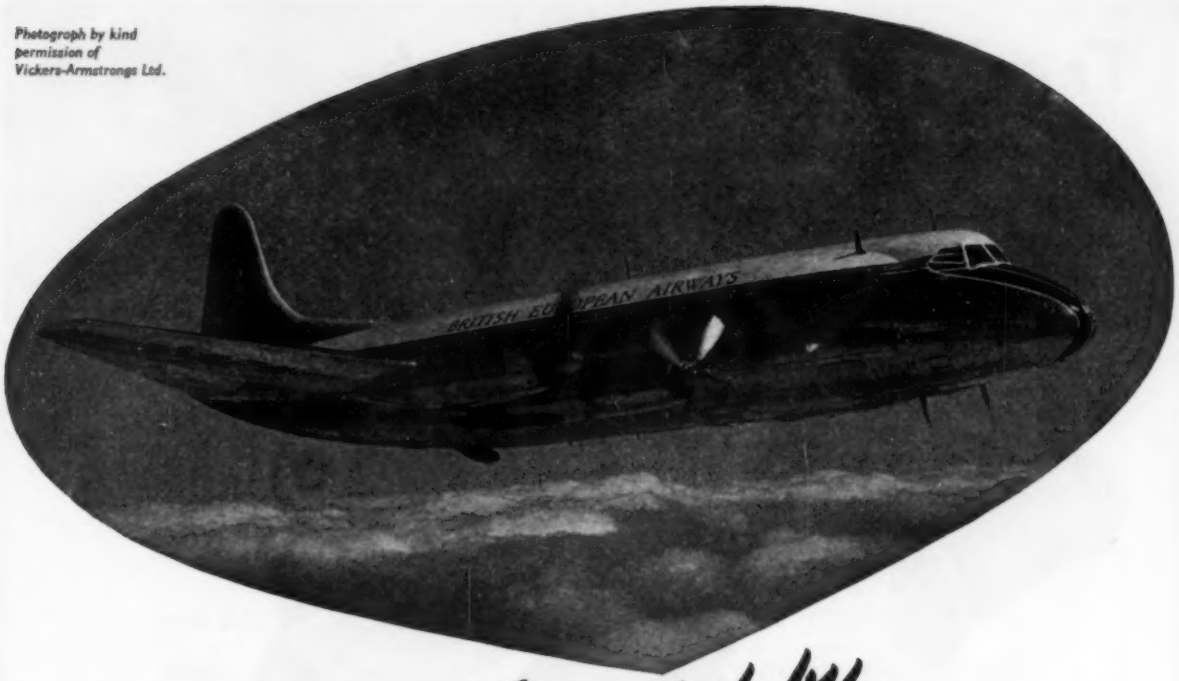

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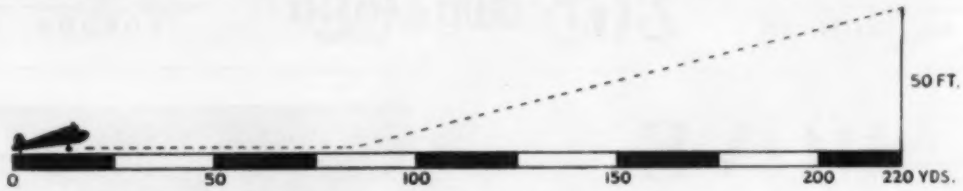

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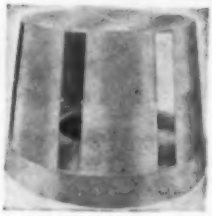

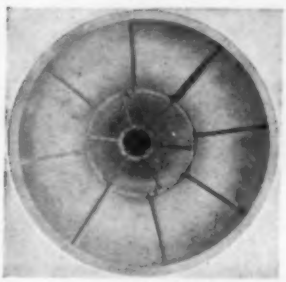

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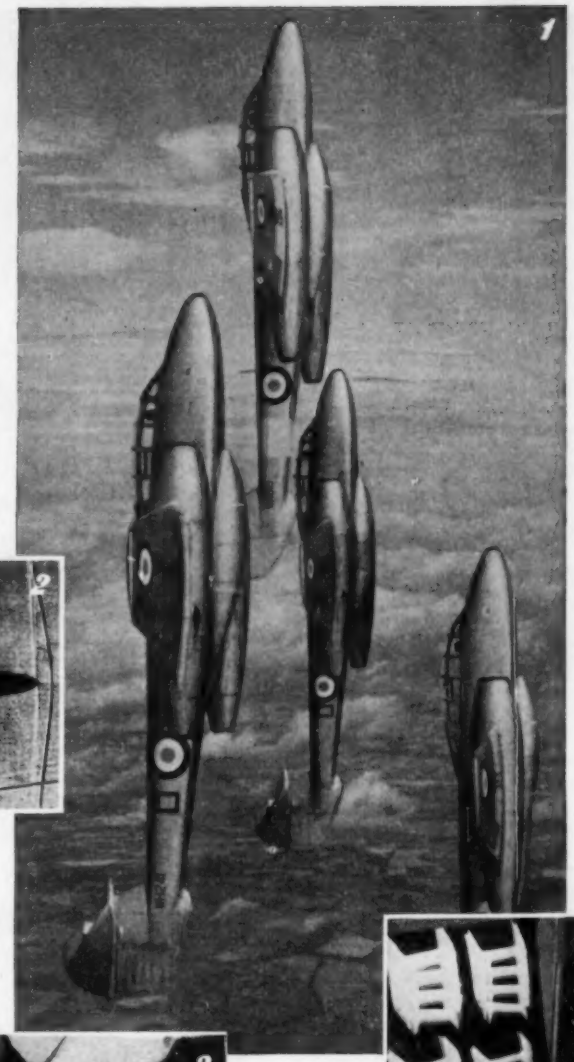

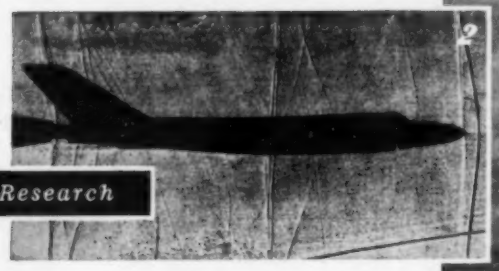

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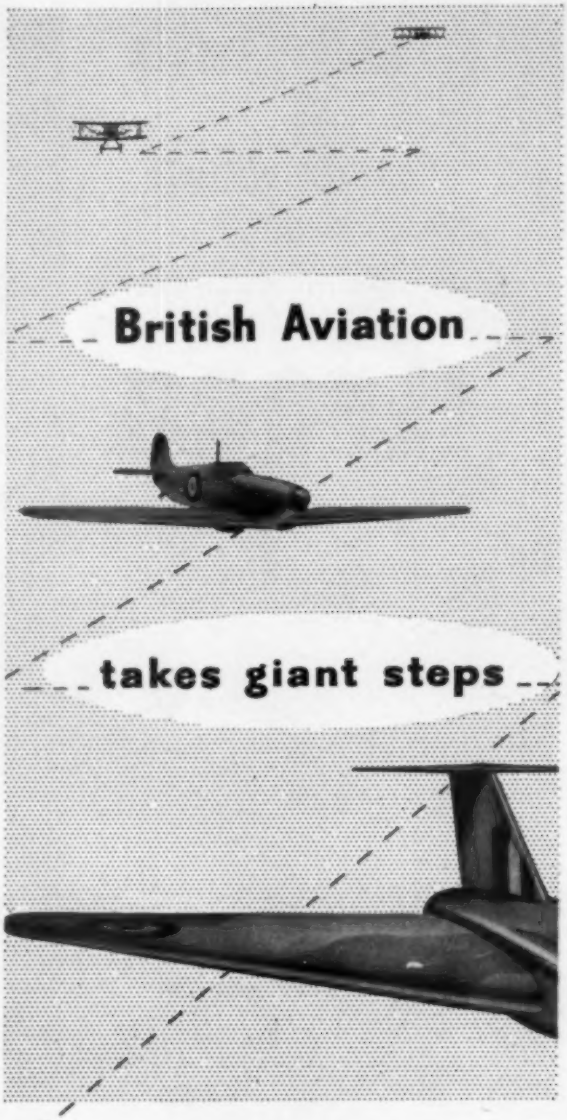

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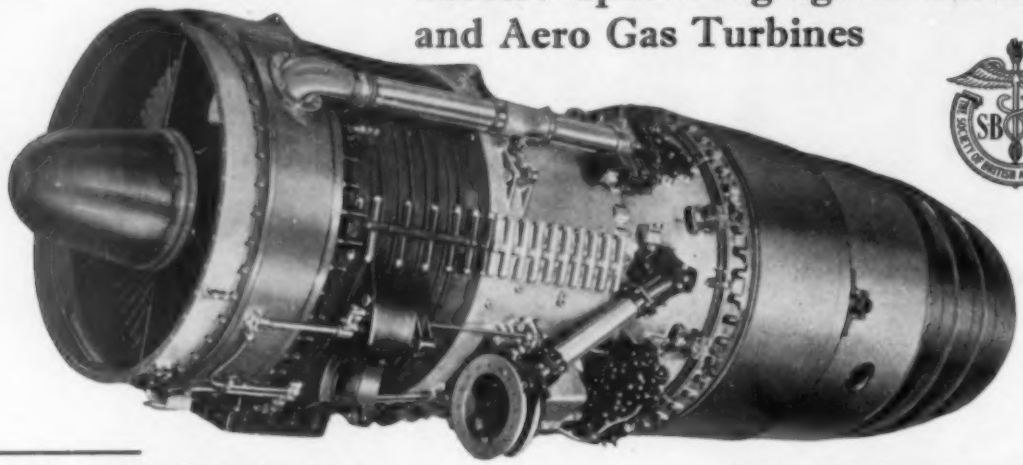

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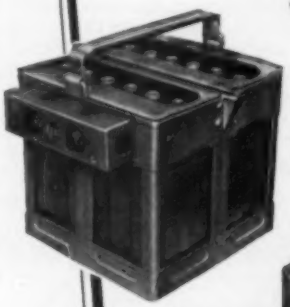

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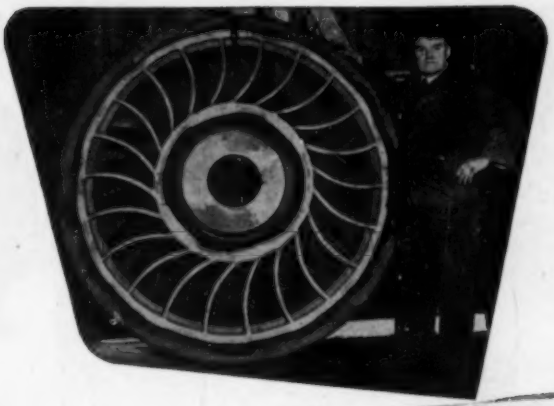

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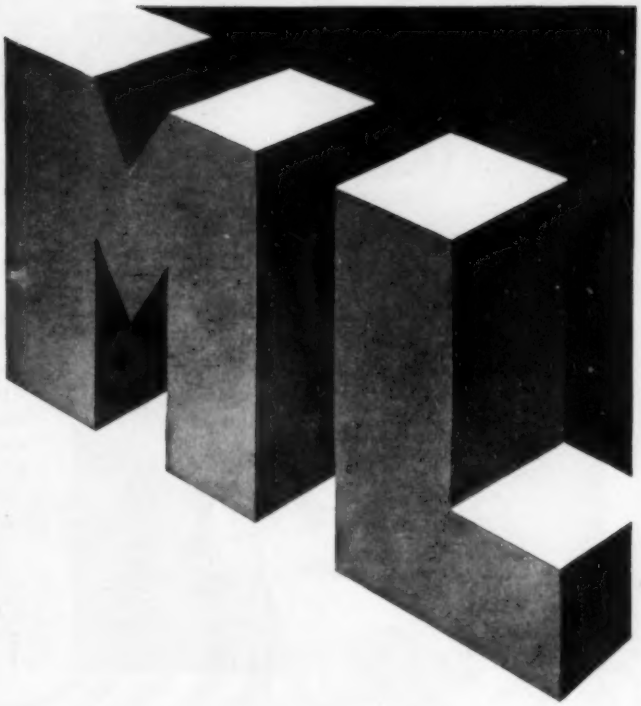

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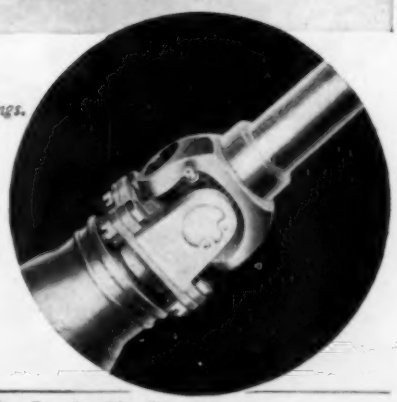

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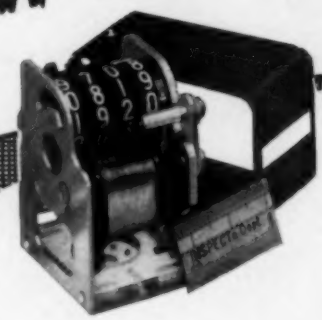

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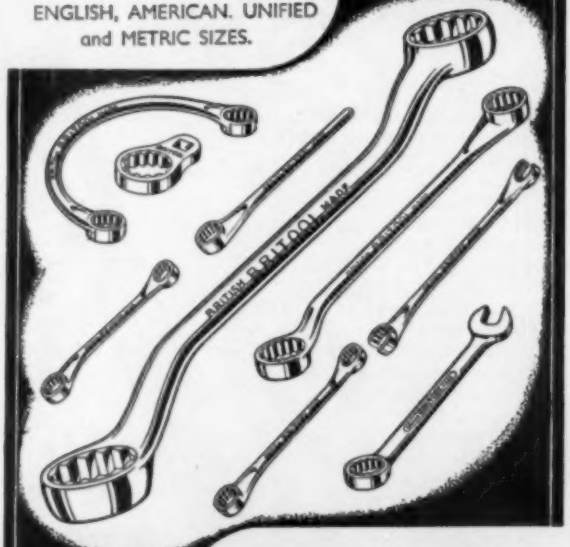

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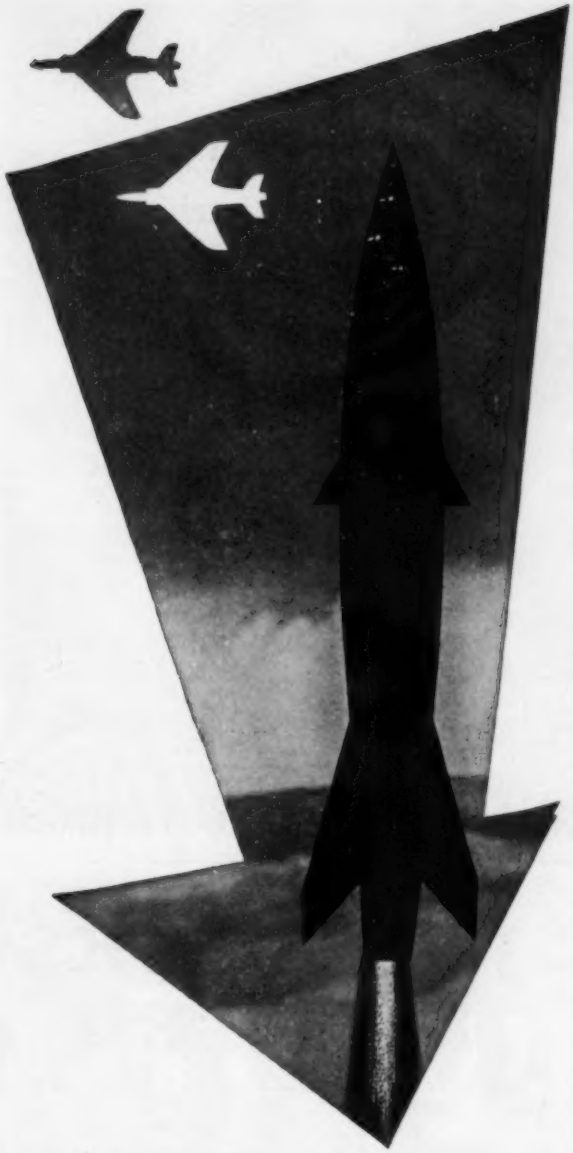

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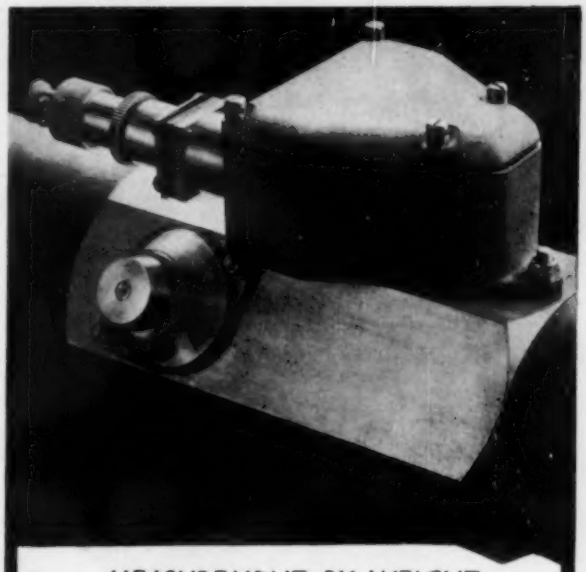

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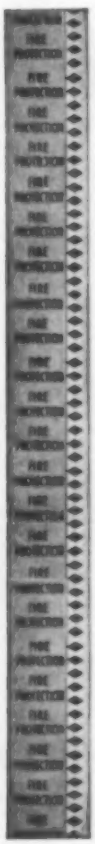

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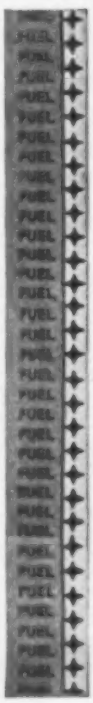

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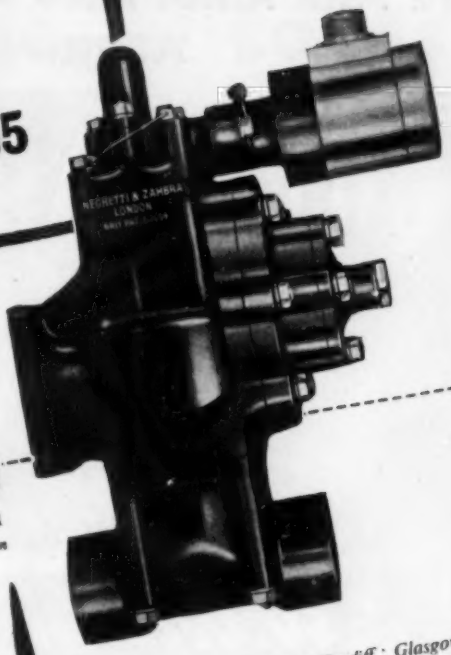

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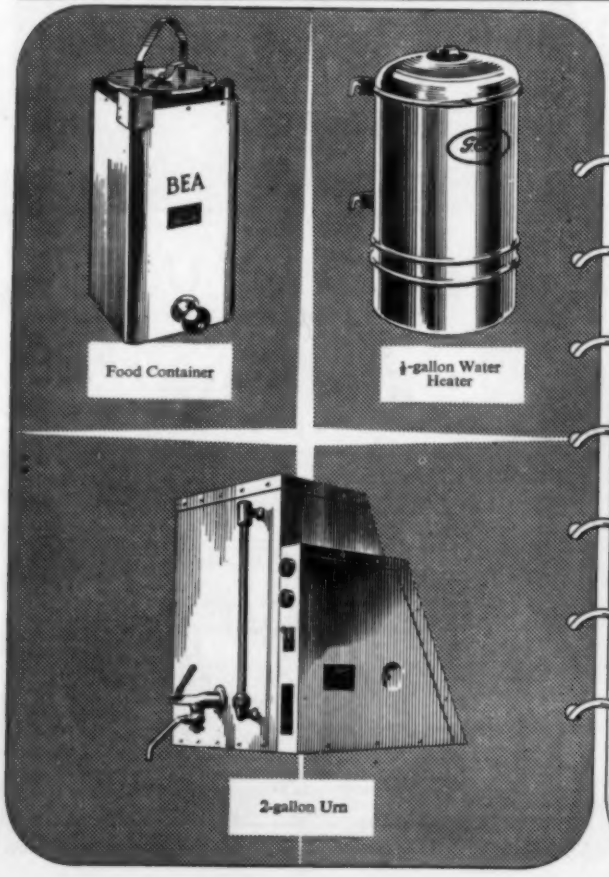

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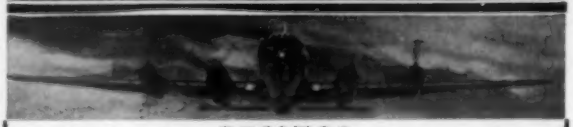

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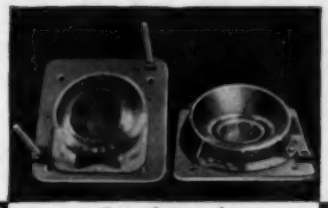

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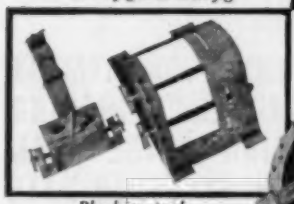
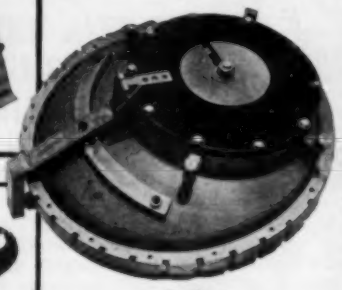
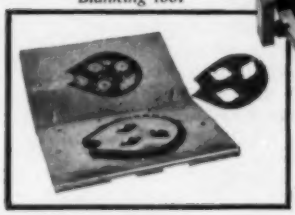
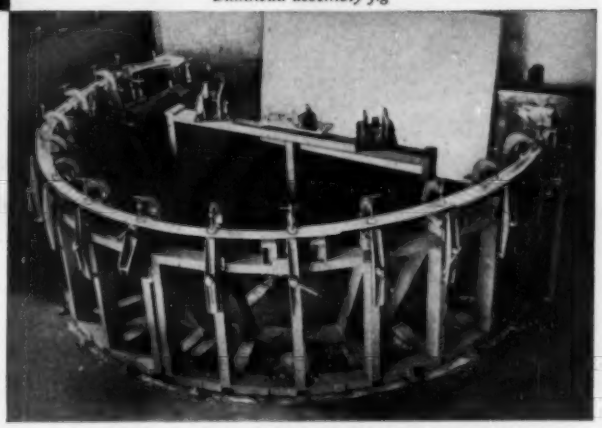


Blanking tool



Drill jig





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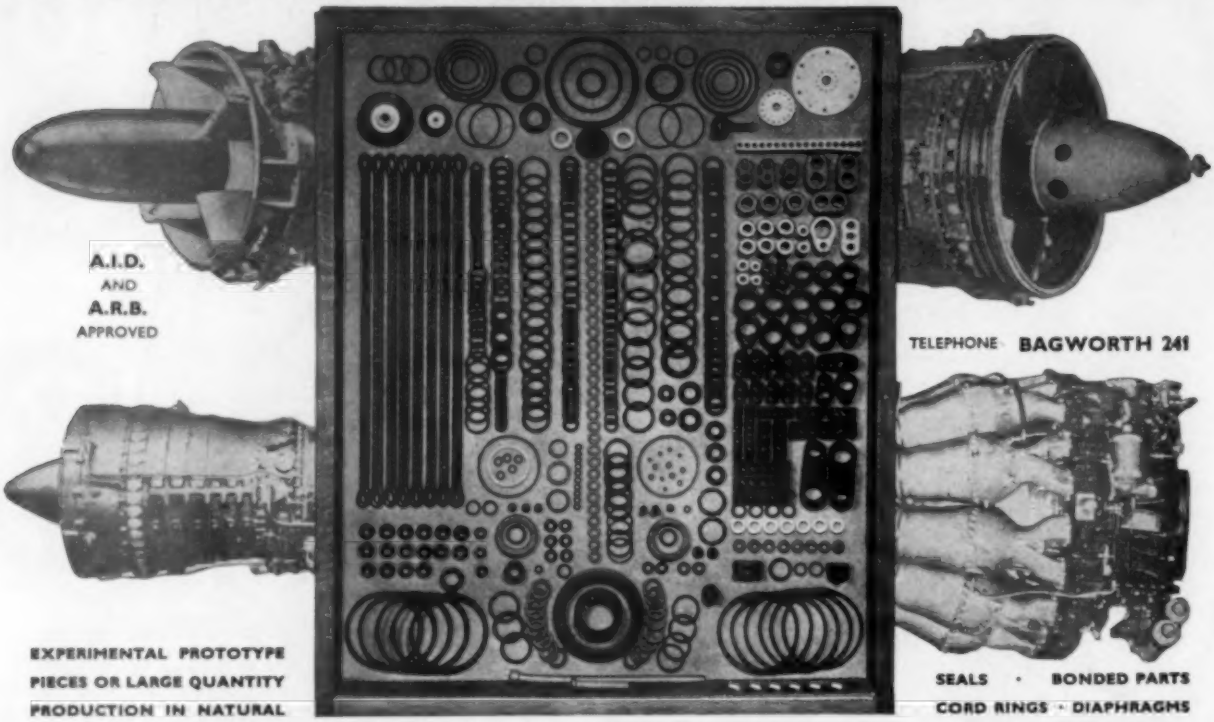

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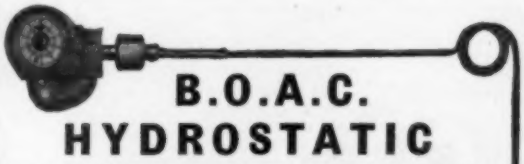

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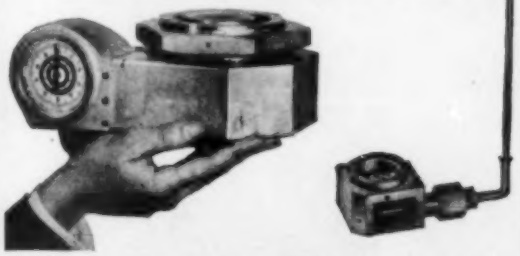

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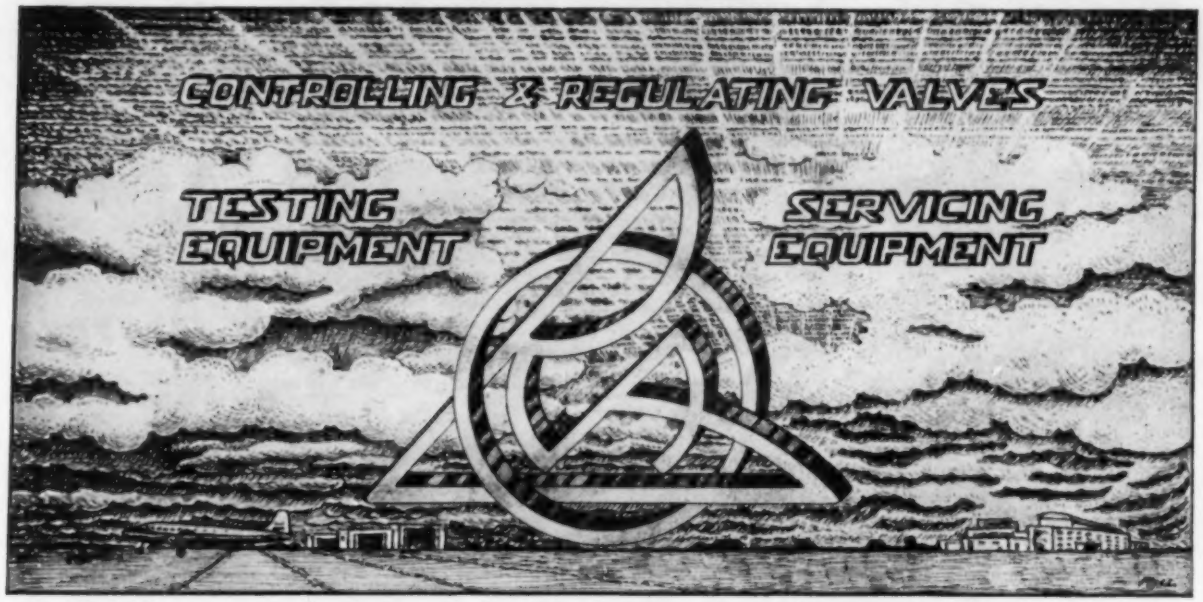

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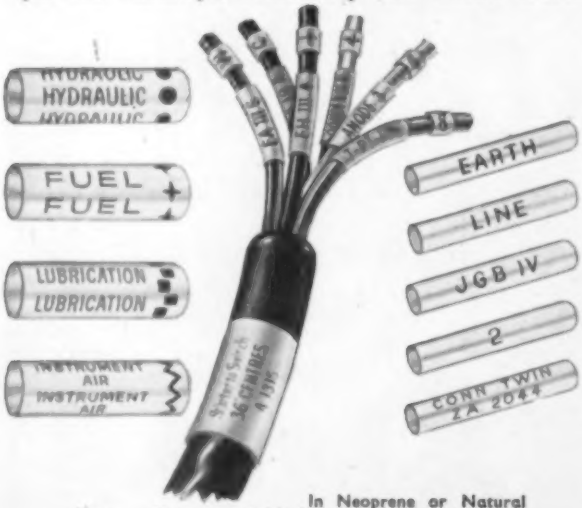

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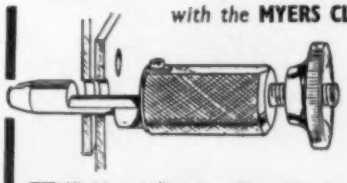

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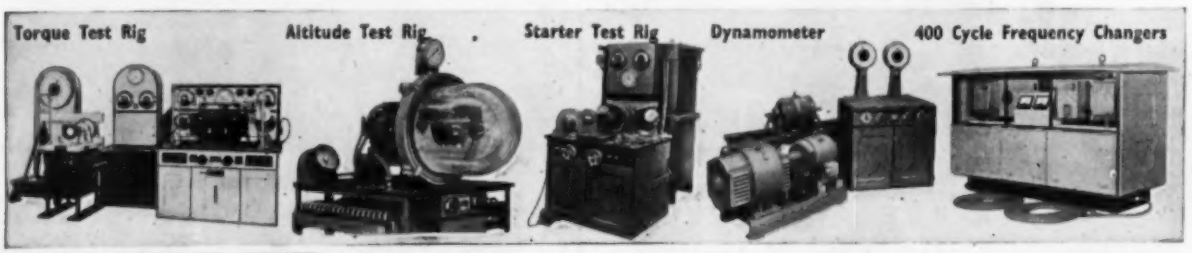

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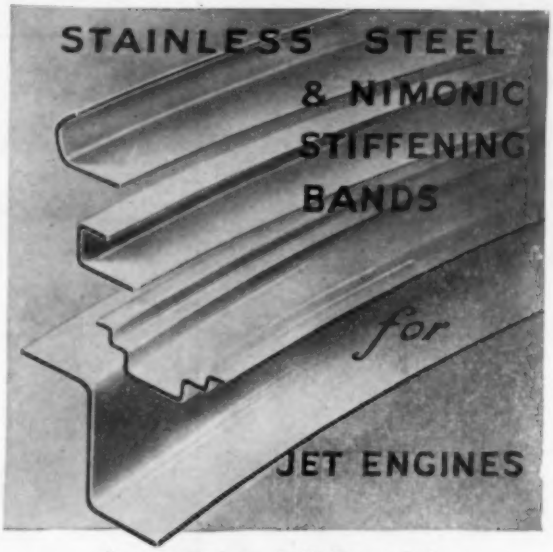

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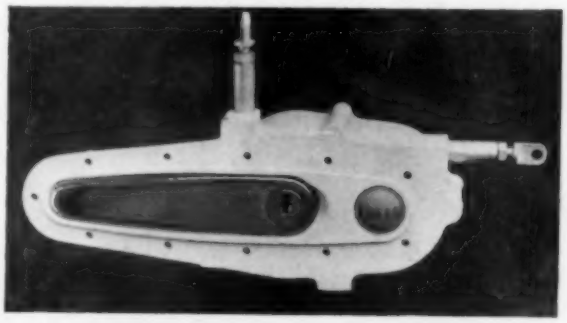

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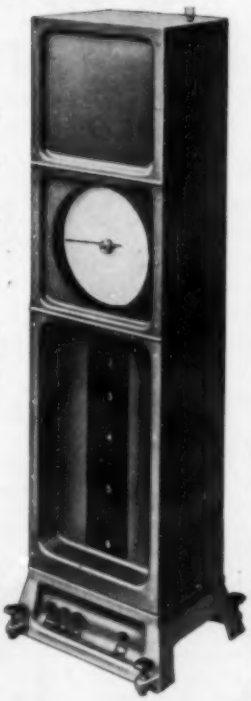

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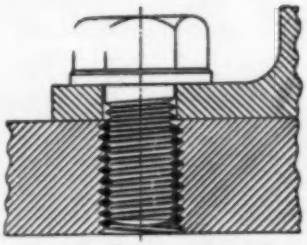

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM Transair, Ltd., of Croydon Airport, Surrey:—

APPLICATION No. 329 for a seasonal inclusive tour service, in conjunction with Pilgrim Tours, with Dakota aircraft, for the carriage of passengers and supplementary freight between London (Croydon or Gatwick) and Santiago de Compostela, at a frequency of from one to two services weekly during the season from May to September inclusive for a period of seven years, commencing May 1st, 1955.

APPLICATION No. 98/1, for permission to increase the frequency on Saturdays on their seasonal U.K. internal service already approved by the Minister of Transport and Civil Aviation (Application No. 98) for operation between London (Croydon or Gatwick) and Jersey on Fridays and Saturdays only during the period mid-June to mid-September each year until 1959, from three to six return services.

APPLICATION No. 330 from Airwork, Ltd., of 15 Chesterfield Street, London, W.1, for a normal scheduled service with Hermes aircraft for the carriage of passengers, supplementary freight and mail between London Airport and Lagos, with intermediate traffic stops at Tangier, Las Palmas and Dakar, at a frequency of from one to three services weekly for a period of ten years, commencing two months after date of approval.

APPLICATION No. 331 from Hunting-Clan Air Transport, Ltd., of 5 Fitzhardinge Street, London, W.1, for a normal scheduled service with Vickers Viscount aircraft for the carriage of passengers, supplementary freight and mail between London Airport and Lagos with intermediate traffic stops at Barcelona or Madrid or Lisbon, Tangier or Casablanca, Gando or Villa Cisneros, Dakar, Bathurst (optional), Freetown and Accra, at a frequency of from one service monthly to one service daily for a period of from seven to ten years, commencing from date of approval.

FROM Transair, Ltd., of Croydon Airport, Surrey, for the following seasonal inclusive tour services with Dakota aircraft, to be operated in conjunction with Swallow Tours (S.T.S.) Ltd., in order to connect with motor coach tours, during the season from May to September inclusive for a period of seven years commencing May 1st, 1955.

Application No.	*Route*	*Frequency*
332	London (Croydon or Gatwick)-Turin	Three services weekly
333	London (Croydon or Gatwick)-Klagenfurt	Two services weekly
334	London (Croydon or Gatwick)-Toulouse	Two services weekly
335	London (Croydon or Gatwick)-Venice	Two services weekly
336	London (Croydon or Gatwick)-Basle	Seven services weekly
337	London (Croydon or Gatwick)-Munich	Two services weekly
338	London (Croydon or Gatwick)-Hamburg	Two services weekly

APPLICATION No. 89/1 from Hunting-Clan Air Transport, Ltd., of 5 Fitzhardinge Street, London, W.1, for permission to operate as from May 1955, Viscount aircraft in addition to the types already authorised on the internal and normal scheduled services approved for operation until March 31st, 1960, by the Minister of Transport and Civil Aviation on the following routes:

London-Newcastle
Newcastle-Manchester
Newcastle-Edinburgh (optional)-Glasgow
Newcastle-Bergen (not yet approved) and/or Stavanger-Oslo-Stockholm
Newcastle-Hamburg-Copenhagen
Newcastle-Amsterdam-Dusseldorf
Newcastle-Luxembourg-Basle
Newcastle-Paris

APPLICATION No. 339 from British Overseas Airways Corporation, of Airways House, Great West Road, Brentford, Middlesex, for a normal scheduled service with Argonaut or Constellation 749 aircraft for the carriage of passengers, supplementary freight and mail between London and Abadan or Abadan and Karachi, with intermediate traffic stops at Zurich, Rome, Nicosia or Beirut, at a frequency of one service per week increasing according to traffic demand during a ten-year period.

THESE applications will be considered by the Council under the terms of reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to these applications must be made, in writing, stating the reasons, and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [2515

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AIRWORK GENERAL TRADING CO., Ltd., have vacancies for electrical instrument and radio inspectors at their Blackbushe Maintenance Depot. Possession of a maintenance engineer's licence an advantage.—Apply to Chief Inspector, Airwork General Trading Co., Ltd., Blackbushe Airport, Camberley, Surrey. Tel.: Camberley 1600, Ext. 222. [2482

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CANDIDATES must have obtained a university degree with first or second class honours in an appropriate scientific subject (including engineering) or in mathematics, or an equivalent qualification; or for scientific posts, possess high professional attainments. Candidates for senior scientific officer posts must in addition have had at least three years' post-graduate or other approved experience. Candidates for scientific officer and patent posts taking their degrees in 1954 may apply before the result of their degree examination is known.

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FLIGHT test observers. If you are interested in the development of gas turbine aero engines, Armstrong Siddeley Motors, Coventry, have vacancies in their Flight Section for flight test observers for flying duties in both low- and high-altitude test-bed aircraft. Applicants should preferably possess a degree or equivalent qualification. All applications treated in strict confidence, should be addressed to the Technical Personnel Manager, quoting reference CG/GTO, Armstrong Siddeley Motors, Coventry. [2484

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TECHNICAL representative is required for the technical service department of large aircraft company. Candidates should be engineers, experienced in the servicing and maintenance of search and navigational radar equipment in aircraft; preference will be given to those with recent practical experience of servicing and maintaining this equipment in the field. One of the conditions attached to this vacancy is that the successful candidate must be prepared to serve anywhere in this country or abroad.—Applications, giving full details of age, qualifications and experience, should be addressed to the Labour Manager, A. V. Roe and Co., Ltd., Greengate, Middleton, Manchester. [2500

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TECHNICAL assistants are required for the Headquarters Staff of the Service Department of The de Havilland Engine Co., Ltd. Work will be mainly connected with the preparation of technical and modification news sheets. Applicants should be preferably over 30 years of age, and should have a good engineering background with previous experience of this type of work.—Written applications only to the Personnel Officer, The de Havilland Engine Co., Ltd., Leavesden Aerodrome, nr. Watford, Herts. [2512

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